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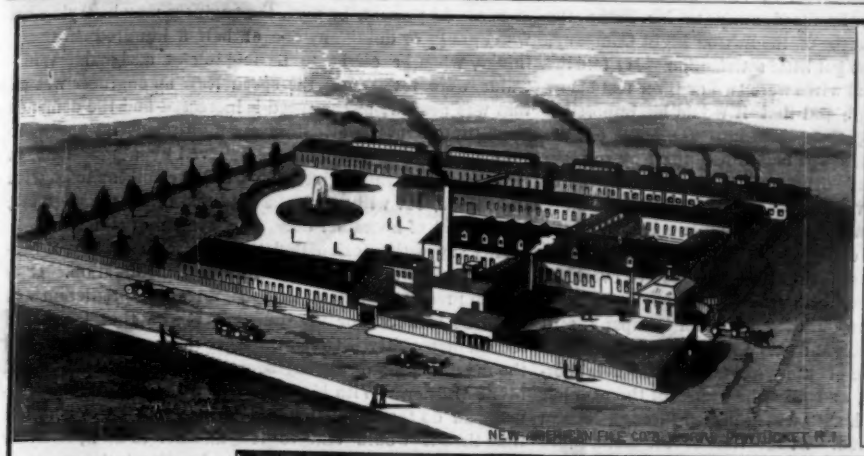

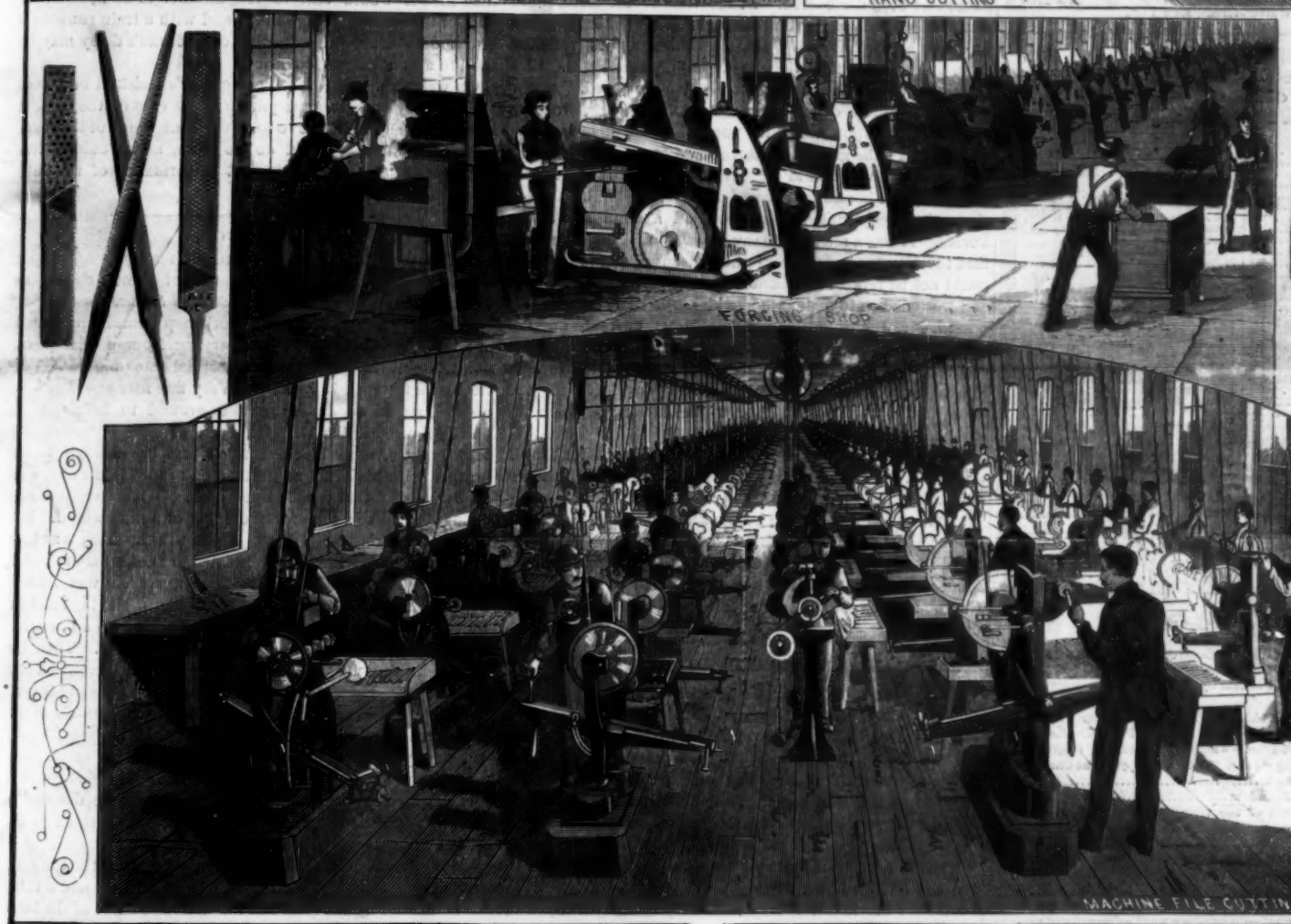

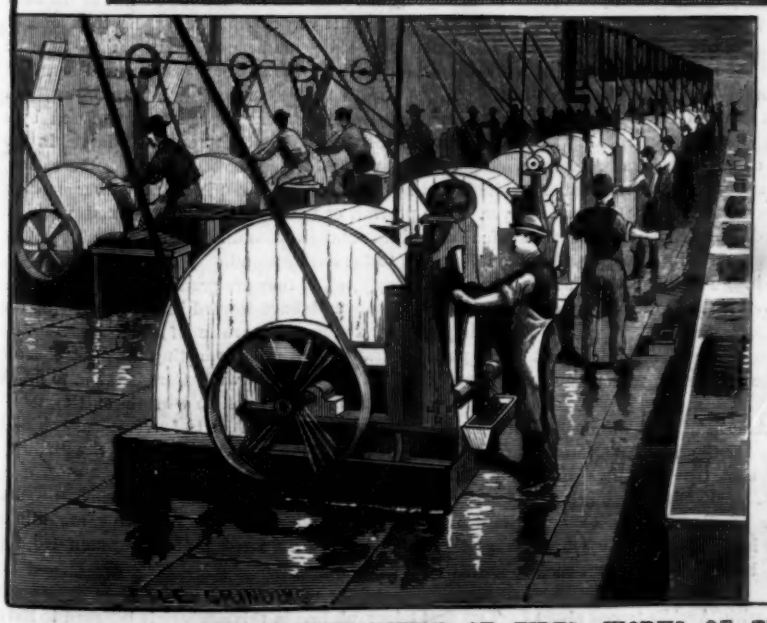

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AN ELECTRICAL YARN.

Some of our city newspapers lately manufactured a sensational story about the wonderful pranks of Edison's electricity, as exhibited at the corner of Ann and Nassau streets. The New York *Sun* produced the longest yarn on the subject, and even illustrated the locality of the pretended electrical disturbance by a diagram. The *Sun's* story went on to relate how passing horses, when they touched their feet on a particular spot in the pavement, instantly received an electrical shock which made them cut up all sorts of shines and didoes. Amusing details were given: the strong cart horse would rear and plunge; the peddler's old hack would rush off on a gallop, etc. It was stated that none of the crowd of spectators, nor the policemen, nor the learned reporter himself, were able to account for the remarkable occurrence. So the indefatigable liner hastened away to Mr. Eaton, the Vice President and Manager of the Edison Light Company, and interviewed him, but got little satisfaction. He told the reporter that the electrical wires were two or three feet below the surface of the ground, and that it would be impossible for a current to come up from them into any horse on the surface. But our penman was not to be put off by so plain and sensible a statement; so he rushed around some more, until at last his perseverance was rewarded by obtaining new and startling information from another employe of the Edison Company, who evidently knows more about electricity, or thinks he does, than Manager Eaton or even Mr. Edison himself. The *Sun* gives the following:

"Mr. Edward H. Johnson, of the Edison Company, said yesterday that Mr. Edison and his assistants had spent the night in an investigation of the wires about the neighborhood of the disturbance, and that the cause of the peculiar effect worked upon the horses which passed through Nassau street had been discovered. At the time of the disturbance Mr. Johnson was engaged at the light in Drexel & Morgan's building at Broad and Wall streets, and a wire reaching from one of the chandeliers to a gas pipe caused the wire supplying one of the currents to become grounded. At the same time a loose cap at Nassau and Ann streets, working intermittently upon the wire supplying the other current, caused that to be grounded also, and an earth circuit was established. It was a mild current, and part of it was appropriated by the horses that passed a certain point, because at that point the ground was not so good a conductor as the horses. It was a mistake to say, as was said on Thursday, that the direct current from the Edison dynamic machine could not be felt. It pricked and tingled very perceptibly, and was enough to make a horse kick up. The current that passed, Mr. Johnson said, was the direct current, and not an induced current. As soon as connection with the loose cap was closed the phenomenon ceased, and buildings were lighted all about the neighborhood yesterday, including one at 88 Nassau street, next door to the house in which the loose cap was found."

It is almost unnecessary to say that this stuff about a chandelier wire and an "intermittent cap" half a mile apart producing an earth circuit and a "mild current," underground, and so making the horses kick up on the pavement, is the silliest of bosh. If this is a fair specimen of the electrical intelligence of the people that the Edison Company sends around to lay their wires, they should be looked after; for good work cannot be expected at the hands of know-nothings.

AMERICAN INVENTIONS IN THE EGYPTIAN WAR.

Among the supplies for the British army in Egypt mention is made of driving apparatus, tubing, and pumps for two hundred "Abyssinian wells," by which name American drive wells are known in England, from the circumstance that they were first used by the British army in the Abyssinian war. It is estimated that two hundred wells of the capacity ordered will furnish from two to three million gallons of water a day, and make the army independent of the surface water sources of the country. Seeing that the fresh water canals are largely in the control of Arabi, the success of the invasion may be largely contingent upon the ability which drive wells give of obtaining water anywhere in the desert.

This, however, does not exhaust the indebtedness of the British forces to American inventors. The great war ships of England are supplied with the Brush electric lamps invented at Cleveland; and, as every reader will recall, it was by means of the powerful lights of the fleet that Arabi's attempts to strengthen the forts about Alexandria, under cover of night and contrary to agreement, were detected and frustrated. After the bombardment began the electric lights played a not less important part in directing the movements of the ships at night, in guarding against surprises, and in watching the movements of the enemy on shore.

During the bombardment the most effective service was done by turreted vessels; and the revolving turret is an American invention.

The machine gun, another American invention, has proved an extremely efficient arm for the invading forces. One vessel fired 6,000 pounds of shot from Gatling guns the first day of the bombardment. A handful of marines, with guns of this type, were able to disperse the Alexandrian "looters" and restore order in the afflicted city, where many times their number would have failed without such aid.

In the subsequent skirmishing with Arabi's troops about Alexandria, and later in the capture of Shaluf and other fortified places along the Suez Canal, the same guns on the gunboats and on shore have been in constant use.

It is not so well known that the small arms of the British soldiers are but slightly modified American guns, made with machinery patterned after that developed in the shops of Springfield, Mass. The system of fixed ammunition for small arms also, and the machines by which such cartridges are made, are all of American origin.

DUTY OF THE LOCOMOTIVE ENGINEER.

A railway man predicts that before many years every locomotive drawing a passenger train on a busy railroad will have a pilot whose sole business will be to watch the signals, switches, bridges, crossings, and so on, while the care and control of the engine will be the exclusive work of the engineer. At present, he says, the engineer may be trying his water gauge or doing any one of half a hundred necessary things, when he ought to be looking at a signal. When trains were fewer and the speed less, an engineer was all that was needed; as the speed is increased and the demands upon the engineer's attention are multiplied, he has more than he can do. He must be relieved by a new man, in front of or over the engine, who will have nothing to do with the engine, but will watch the road and direct the engineer, as the pilot of a steamer does, by a system of signals.

Any suggestion calculated to increase the safety of railway traveling cannot fail to receive consideration. It is safe to predict, however, that the foregoing prediction will never be fulfilled, for the sufficient reason that to place a second personality between the observation of a signal and the manipulation of the engine would be to delay action and invite disaster. With his hand upon the throttle the engineer can do the thing required in any emergency in less time than it would take to tell another to do it, however perfect the system of signaling; and with a train running a hundred feet a second, a fraction of a second's delay may be fatal to a hundred passengers.

On well regulated roads the engineer's assistant now does substantially everything required in the care of the engine, leaving the engineer free to keep constant watch of the road. The proposed pilot could do no more, and would be less fitly placed to secure the instant performance of the duty the occasion might demand.

Cameo Cutting.

One of the best examples of adroit manipulation under the simple microscope is the operation of cameo cutting as described in an article in *Our Home and Science Gossip:*

A visit to a cameo cutter's workshop found him seated at a table covered with tools, varying from a triangular-pointed steel instrument to the most delicate pointed bits of steel wire fastened in handles. Very fine files and knitting needles, set in wooden grips and ground to infinitesimal points, figured in the lot. On a pad of leather, before the cameo cutter, was a block of wood just big enough to be grasped with his hand, and cemented to the middle of it was an oval object that looked like a piece of alabaster, just big enough to make a seal for the finger of a man who did not object to wearing large rings. Upon this the artist was just finishing a copy, with a pencil pointed to needle fineness, of a photograph in profile of a gentleman, which was leaned against a little photograph easel before him. Having finished the outline, he laid his pencil by, and taking up a fine wire tool he scratched the pencil mark around with it. Then he took a darning needle with a sharp point and scratched the line deeper. He worked with a magnifying glass at his eye, and stopped continually to inspect the progress of his work with critical minuteness. Then he went at it again, working slowly, scratching over the same line again and again, and always examining after each scratch. He changed his tools as he went on, and from the darning needle descended to a trifling little fragment of steel wire, not as thick as an ordinary sewing needle, set in a slender handle.

With this he scratched and rescratched, until the lines he had drawn with his pencil had quite vanished, and a thin, fine streak of a dark color had marked the outline of the head he had been tracing his way around. Next he took one of his burin-like tools and commenced again. This time he worked on the outside of the outline, cutting and scraping at the surface until the white turned gray, then brown, and finally vanished, leaving the face in relief, surrounded by a black ground—that is, the portrait remained intact in the white substance which formed the outer layer of the cameo, while it had been cut away around it to the lower or dark layer. The portrait or figure is then modulated upon its surface until it assumes the roundness of nature. The edges are left square to the dark ground.

This is necessary, as, if they are gradually rounded down, the outline becomes undefined toward its juncture with the relieving surface, owing to the white of the raised portion being partially transparent and permitting the dark to show through it when it is thinned down. Care is taken to finish this dark surface as much as possible with the cutting tools and so separate the white from it as to leave it smooth and unscratched. A final polish is given it, however, with putty powder applied dry with a stiff brush, but the utmost care is necessary in this operation, as the slightest slip will ruin the work. This is the cameo cutter's work, the mountings being the jeweler's work. The cameos sell, unmounted, for about twenty-five dollars.

THE first telegraph line in this country is believed to have been established on Long Island, by Harrison A. Dyar.

IDLERS AS INVENTORS.

It is popularly supposed that, in order to invent a machine for any particular purpose, one must be an expert in the particular business for which the machine is designed. To a certain extent this belief is correct, but it somehow happens that many of the most valuable inventions have been brought out by persons who had no practical experience whatever in the use of the machinery appertaining to the business for which their inventions are designed. It is not denied that many of our most valuable inventions are the works of mechanics and operatives of machinery; but it is asserted that a great many valuable inventions have been brought out by men who had no practical experience either as mechanics or operatives in the line of their inventions. It frequently happens that persons who have no special knowledge of machinery, when looking at the performance of some engine or other machine, discover a chance for improvement and drop suddenly into the highway to fortune.

The writer has just had an interview with a young man recently graduated at a medical college. His mind is not on pills or amputations; but he fancies he can see opportunities for improvements all around him, and he is now developing several important railway inventions, a sheet music turner, and several other devices not in any manner connected with his chosen profession. One would suppose that his inventive genius would turn to surgical and dental instruments, artificial limbs, etc.; but he, like thousands of others, leaves his chosen path, seemingly led astray by some invisible power over which he has no control. A man with no calling or profession is usually styled a "loafer;" yet many valuable inventions have been produced by such men.

One of the greatest inventions the world has ever seen was whittled out by an idler in a few minutes. He caught the idea by seeing a man trying to get an implement repaired. He saw the affair was imperfect, improved it, and revolutionized the world in its most important industry. He was no longer called a loafer, and although long deceased, he is now, and will be as long as the world exists, regarded as one of the greatest inventors ever known. It is by no means meant that all inventors are men of no steady occupation; but it is an undeniable fact that many of our most valuable inventions are from the brains of men who were considered as idlers and of no account.

This is not mentioned here to cast any reflections on inventors as a class; for it is well understood that we are wholly indebted to them for the wonderful progress the world has made and is making, but to encourage that class who have no faith or confidence in their inventive abilities and therefore make no efforts. In many communities the man who gives his time to perfecting some device is styled a "lazy good-for-nothing;" but when he finds himself successful his old acquaintances are pleased to know him. It will be seen that our inventors range from millionaires down to loafers, or rather *vice versa*. Perhaps the term "loafer" is hardly appropriate; but as there are so many of them who ultimately take their places in the ranks of the industrious and wealthy, some allowance may be made for the seeming slur on a very worthy class of people.

The mechanic who has to win bread for himself and family has hardly time to devote to inventing; but the idle man who has nothing to do, if he keeps his eyes open, carries off the prize in many instances. But there are many who have an idea that they cannot invent because they are not possessed of means to develop their ideas. They look ahead to those who have been successful and say, "They have been lucky, and have means to handle their inventions, while I am without a dollar and can do nothing" Most of our successful inventors have been those who had no means in the shape of cash, but they had its substitute—*pluck*. There are hundreds of men who might pick up some valuable ideas and work them into shape if they were possessed of the requisite pluck. It will not do to sit down and say, "I wish I could invent something." Our successful inventors were not of this stamp, and this is written to encourage all who have a taste for invention to reach for a successful development of their ideas and put them in practical shape. To conclude: Our inventors are men of pluck, and may be regarded as our best citizens, even if they were once idlers.

CAR COUPLINGS IN ENGLAND.—A CHANCE FOR AMERICAN INVENTORS.

The Amalgamated Society of Railway Servants of England, Scotland, Ireland, and Wales, will hold an exhibition of working models of improved railcar couplings, at Darlington, Eng., from the 3d to the 7th of October next.

American inventors are invited to send models, securely packed, to F. W. Evans, Exhibition of Railway Appliances, Mechanics' Institute, Darlington, England, under whose direction they will be packed for return after the exhibition is over. All exhibits must be received on or before September 30. The Board of Trade will grant a certificate protecting the patent rights of inventions exhibited, and promise to direct the attention of railway inspecting officers to the exhibition, as they have every wish to encourage the examination and consideration of such appliances.

It is reported that out of an estimated total of from twelve to fourteen thousand train men on British roads, 206 were killed outright and 1,614 injured, during the five years ending with 1880; a large proportion of these accidents being due, in the opinion of the Amalgamated Society, to the present mode of coupling cars.

During the period mentioned there were about 17,000 miles of railway open for traffic in the United Kingdom (16,658 miles at the end of 1875, and 17,696 at the close of 1879). The number of passengers carried, not counting season ticket holders, was 507,532,187 in 1875, and 562,732,890 in 1879. The freight receipts were about $300,000,000 a year.

For this amount of traffic, the average of forty train men killed and four hundred hurt during each year, seems very small in comparison with like casualties on American roads.

At the earlier date specified, the United States had about 75,000 miles of railway in operation, and now have 100,000. Our railway mileage was thus, during the period covered, about five times that of the United Kingdom, though the traffic was not proportionally large, the population of this country being much less dense.

The casualties among train men in the United States, if the business were conducted as carefully as in Great Britain, should not exceed two hundred killed and two thousand hurt in the course of a year. Competent railway officers give the actual losses as from 1,200 to 1,500 killed and from 5,000 to 10,000 injured every year.

The disproportion is tremendous. Is it due to the greater carelessness of American train men, to the use of less suitable coupling appliances, or to a different mode of making up and handling trains?

It is hardly credible that the train men of American roads can be five or six times less careful of their lives and limbs than the men employed on English roads and in English car yards.

It is probable that there will be found a greater variety of cars and far less uniformity in coupling appliances, in the average American train—especially freight trains—than in English trains, owing to the vastly larger number of connecting lines here, and the general intermingling of cars from many roads. All these differences increase the hazard in making up and handling trains; still it may be questioned if they are great enough to account for the excessive loss of life and limb experienced here.

It is pretty certain that if, in the proposed competition, it should appear that the couplings in general use here are less safe and efficient than those the English use, or that devices existing, but not adopted, are calculated to lessen the number of casualties, the public attention that will be drawn to the matter must hasten the adoption of the better methods and appliances. In this way the exhibition is calculated to do much good.

Inventors who are curious to compare their ideas or inventions with the couplers used or proposed in England will be interested in a critical paper by T. Atwood Brockelbank, of England, on "Improvements in Railway Couplings as a Necessity of the Day," printed in No. 21 of the SCIENTIFIC AMERICAN SUPPLEMENT. It is copiously illustrated, and presents clearly and forcibly the conditions of the coupling problem as developed on British railways.

Singapore as a Market for American Edge Tools.

In a recent report to the State Department, Consul Studer, at Singapore, gives the following information with regard to the edge tools used in that region and the possibilities of American trade there:

"The sale of edge tools, notwithstanding the fact that Singapore is in the center of one of the heaviest timbered regions in the world, is almost null and void; this, in a great measure, is owing to the absence of an able and practical American agency for the introduction and sale of the same. Another good reason is, that the mechanics here using edge tools are very nearly all Chinamen, who bring their tools with them from China, or buy them here from their own countrymen. The Chinese are used to these tools, and they are always of excellent temper, answering well among the hardest known woods here. It may be known to some, but not generally, in our country that the Eastern races understand how to harden or temper steel for edge tools and weapons in a manner superior to any other peoples or races. I have myself seen the edges of 'perangs' (the 'macbeta' of the Malays) and 'klewangs' (the largest battle-sword of the Malays) tried, by cutting copper coins in two, without showing marks on the edges (this often), and once a wrought nail with a like result. It would be almost impossible to induce Chinese merchants to adopt our edge tools. Such among them, carpenters, as have been in the United States, or served on American or European vessels, might perhaps form an exception to this rule; but their number, comparatively, is rather limited. The shipping being very large here, especially steamers, the ships' carpenters are the best customers of 'civilized edge tools,' and buy them in the ship chandleries, and these are nearly all of English manufacture; but such a thing as a 'tool chest' after American pattern is not to be had. Our manufacturers of edge tools, or their agents, must take the matter in hand if they want to sell their products here successfully. The Malays living in the jungle, and who clear the same upon contract for planters, cannot be induced to lay aside their weird and strange looking light axes for American axes.

"This has been tried repeatedly by the tobacco-planters in Sumatra. Their axes resemble a narrow shaped hatchet (such as the planters use in the United States), only that they are longer and a little wider, and that the eye for the helve, round in shape, is in the hammer part, or upper end of the ax. Their helves are much longer than ours, of elastic wood, and only as thick as an average broom handle. The helve is so fastened to the ax, with rattan thongs, as to prevent it from slipping or turning in the eye. Very nearly all species of wood in this region are hard, and some exceedingly hard, and it is wonderful to see with what dexterity they handle their chisel-like axes—how they make the chips fly, and in what a short time they make a tree fall. They make contracts for cutting down jungle at very low figures, but that contract does not include the burning of what they cut down.

"The planting coolies must do the latter part, which, in order to produce a good ready burning, requires much ax work. Not so many years ago the coolies used for this work the Malayan ax ('bilian,' in Malay); but gradually the planters managed to induce them to use American axes, though without the American-shaped helve, they preferring straight helves. This change in axes required much persuasion, but after a few had tried our ax, and found what effective work they could do with it, the rest of the coolies on all the neighboring plantations soon followed, and now they could not be induced to exchange them for others. I am alluding to the tobacco-planting districts of Deli, Langkat, and Sirdang, all lying close together, for which Penang, in this colony, has ever been the place of import for all things needed from abroad, as well as the place of shipment of their tobacco to Europe. The port of Penang, and not Singapore, has become the place of import for American axes; and, if there was an immediate demand for the same here, firms who have their agents or branches in Penang would get them from there. Other countries, I have been told, have endeavored to compete with our manufacturers in this article, but they cannot. Those Chinese coolies know the shape, quality, and trade marks of the axes they have been using, and (it has been tried) they will not, as the planter-employer makes them pay for them, buy any of different shape or trade mark.

"There are various patterns of Malay axes throughout the Indo-Malayan Archipelago, and a collection of them would be very interesting and instructive, but it would require both time and money to make it. I mention this for the information of manufacturers of edge tools, knowing that they are anxious to get new patterns.

"With such a collection should also be sent a few kinds of '*perangs*,' or underbrush choppers, which in shape resemble our American corn-cutter, and are from 18 to 22 inches in length, forming a slight outward curve from the handle to about five-eighths of the length (I mean edge outward). The blade in the middle is about 1¼ inches in breadth, tapering off slightly to the end, where the breadth is about 1 inch; others, again, have the same breadth for three-fourths the length from the end. The thickness of the blade, lengthwise, is greater in the middle than at the back, forming what is called check the whole length, the center third of the blade protruding, generally, a little more than the other thirds. There is a wooden or horn handle to it, well shaped for the hand to make the grasp easy and firm, and a downward curve or hook at the end to prevent it slipping out of the hand. The Malays use this '*perang*' for all ordinary jungle cutting, excepting trees of over 10 inches diameter; and great is their dexterity in the use of the same. It is also their favorite weapon in combat with the ferocious beasts of the jungle. In fact, a great number of land Malays, called 'Rayols' (distinct from the 'Orang laut,' who follow the sea, or are fishermen), have absolutely no other weapons than the '*bilian*' (ax), the '*perang*,' and the '*kris*' (dagger), which latter they carry in their girdles, and occasionally spears of hard wood (of the '*Nebeng*' *palm*), with or without iron points, and variously shaped knives of native make. There has been more activity displayed by Europeans in various provinces on the peninsula under British rule, during the past two years, toward selecting, securing, and clearing, as well as planting land, and this may be the means of creating a greater demand for edge tools, axes especially, as well as saws of various kinds."

Overhead Fire Escapes.

A Tasmanian correspondent suggests as a fire escape a passway of iron along and above the roofs of houses; passing through the more lofty buildings if need be, or diverging to the right or left, so as to bridge over and connect all the houses of a block, thus securing an easy and safe passage from any house to those adjacent, as well for the convenience of firemen as for the escape of those who are beset by fire. The construction of these iron passes, he says, could be fairly compulsory to owners, and they need be by no means of an unsightly appearance. When wished, they could be elegantly constructed to conform to the general architecture of the building by or through which it passes, and this would hold good with regard to the means by which each house was connected with this proposed passway. He is aware that there are disadvantages which at once crop up—apparent danger from burglars, and so on—but there is no good without its modicum of evil, and this weakness of his plans, he thinks, could be overcome and guarded against.

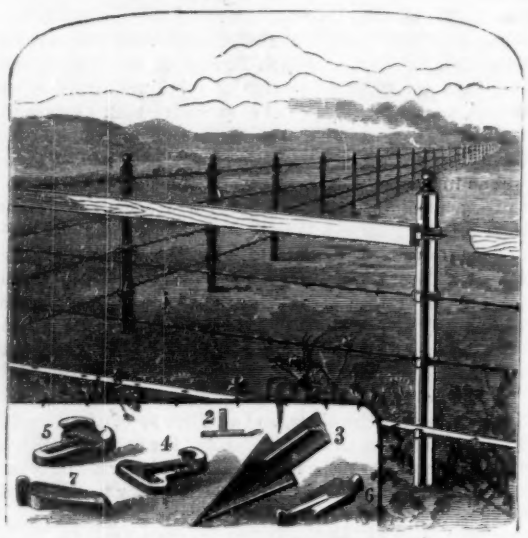
Elevated Railroad in Cleveland.

The first passenger train over the New York, Chicago, and St. Louis Railroad, from Chicago eastward bound, passed through Cleveland, Ohio, August 30. The heart of the city is traversed by a system of bridges and viaducts, that carry the tracks above the streets and all other roads for a distance of nearly a mile. The cost of this portion of the road was about $250,000.

IMPROVED FENCE.

We give herewith an engraving of an improvement in fences for farms, railroads, and all inclosures requiring a light, easily constructed, and inexpensive fence. The principal novelty in this invention is the post and the fastenings. The post is made of rolled T iron or steel, with flanges riveted to the lower end to give it a firm bearing in the soil. The flanges are triangular, and form a pointed shoe (as shown in Fig. 3), which may readily be driven into the ground. This post, while very light, possesses ample strength for resisting any strain to which it is liable to be subjected. The post may be made of a single bar of T iron, or it may be made of two flat bars arranged at right angles to each other and clamped together by the clamps used to secure the wire to the posts.

The barbed wires or bands or board strips used in forming the panels are all secured in place either on the flat or ribbed side of the post by means of the clamp shown in Figs. 4 and 5, and the keys shown in Figs. 6 and 7.



POWELL'S IMPROVED FENCE.

The clamps are each provided with a recess for receiving the wire and clamping it securely against the post, so that it cannot be lifted out of place.

Any kind of barbed or plain wire or barbed or plain strip may be used in connection with the post, and, if desired, wooden rails may be used, the rail at the point where it comes into contact with the post being chambered out to receive the end of the clamp, and a wire being placed across the chamber thus formed, to be received by the clamp.

The corner posts of this fence are supported by an internal brace, and the lower posts, in long stretches of fence, are furnished with an extra stay, to keep them from being drawn out of the ground.

This fence is readily put up, is very cheap, and at the same time durable. It is capable of being adapted to door-yards, lawns, etc., and, when nicely painted, has a light and attractive appearance.

Further information in regard to this useful invention may be obtained by addressing Mr. T. S. Peck, Burlington, Vt.

VERNIER AND MICROMETER CALIPERS.

The instrument shown in the accompanying cut is designed for use in shops where great accuracy in measurement is requisite. The object of the apparatus, which is the invention of Mr. Aug. Cuvillier, is to measure with exactness to the hundredth of a millimeter, not only slight thicknesses, as is done with the metal gauge, but also great thicknesses, as is done with the vernier calipers. Mr. Cuvillier's objection to the latter is that they are wanting in accuracy, owing to the fact that the vernier gives only tenths of millimeters, and that the eye often fails to recognize the division on the vernier that coincides with one on the rule. Such a criticism appears to be exaggerated; for, when the division is correct, and when the marks are sufficiently distinct, unless an observer be far-sighted, he can not only read the tenths, but can also readily estimate the twentieths of a millimeter.

Moreover, were such an instrument as this provided with a vernier giving the twentieths of a millimeter, and a stationary lens of five to six centimeters focus, there might easily be obtained, by estimate, fractions up to nearly a hundredth of a millimeter. However this may be, Mr. Cuvillier has had no desire to have recourse to such an optical amplification, which might perhaps render the instrument too fragile, but has sought a method for reading the hundredths of a millimeter on a scale having wide divisions. He has solved the problem as follows:

Fig. 1.

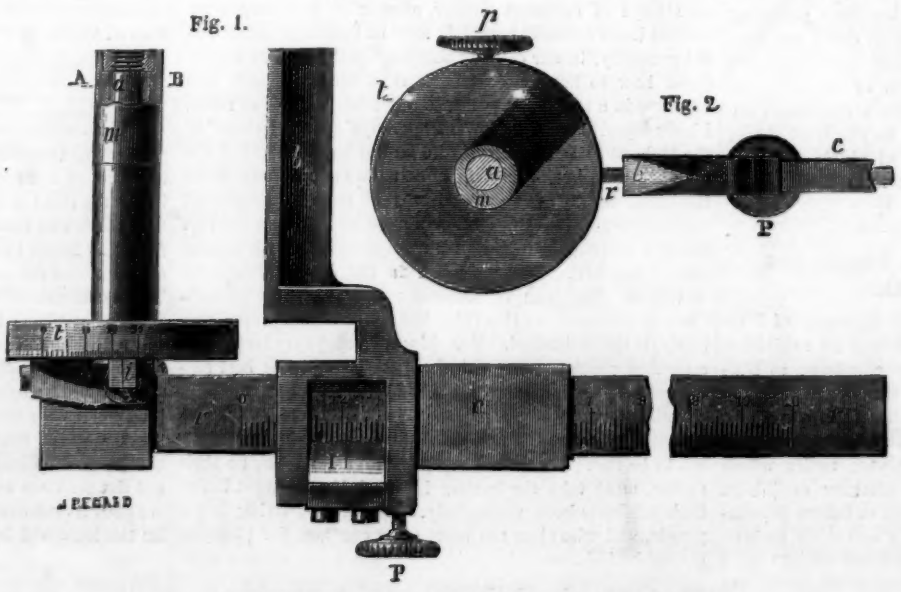


Fig. 2.

VERNIER AND MICROMETER CALIPERS.

His instrument consists of a rule which is divided into millimeters and along which slides a box carrying a movable arm. On this box, instead of a vernier, there is traced a simple datum point, designed to be brought opposite any point whatever of the division of the rule. A set screw permits of the box being secured at any part of the rule. At the extreme left of the latter there is fixed a cylinder which performs the role of a stationary arm, and which consists of two pieces—a steel axis fixed to the rule, and a steel sleeve which revolves on such axis. The aperture in the sleeve is made eccentric by a half millimeter with respect to the external cylindrical surface, so that at the two extremities of a same diametral plane, the thicknesses of the sleeve differ by one millimeter.

It results from this that if, after setting the sleeve so that the generatrix corresponding to the least thickness is in contact with the movable arm, the sleeve be given a half revolution, the greatest thickness will come opposite the said arm, which then will have to slide back one millimeter. But, during the half revolution of the sleeve, the backward movement will have been progressive, and will have passed through all the values comprised between 0 and 1 millimeter. The values of these displacements are read upon a disk, which is fixed to the base of the sleeve and centered upon the axis, and which carries an equally divided scale, each division of which corresponds to a displacement of a hundredth of a millimeter. The reading on this division is effected by the aid of an index fixed to the rule. Measuring with the instrument is performed as follows:

The division 100 of the disk is placed opposite the fixed index, and then the box of the sliding arm is fixed in such a way that its index is opposite a division of the scale, and that the distance of the arms exceeds by less than one millimeter the size of the piece to be measured.

Afterward the sleeve and disk are turned until the piece is slightly grasped between the two arms. Then opposite the datum point of the disk there is read on the scale of the latter the number of hundredths of a millimeter that must be added to the entire number of millimeters indicated on the rule by the index of the movable arm. The reading of hundredths is effected, moreover, without hesitation or fatigue; for each of them corresponds on the disk to an interval whose minimum is a half millimeter.

The instrument will be more readily understood from the following description of the figures:

Fig. 1—Elevation. Fig. 2—Plan and section in the direction AB. *r*, steel rule divided into millimeters; *c*, brass box which slides on the rule or bar; *b*, movable steel arm brazed to the box *c;* I, index that may be set opposite any one of the divisions of the rule, and which is flanked by two small divisions which are equal, and less than one millimeter. A comparison of the distances between these divisions and two divisions of the rule insures of accuracy in the concordance of the index, and of the corresponding division of the rule. P, set screw for holding the box in any desired position; *a*, steel axis of the stationary arm fixed at the extremity of the rule; *m*, steel eccentric sleeve revolving about the axis, *a;* *t*, a graduated disk, brazed on the sleeve and centered upon the axis, *a*. According as the divisions on this disk, which are numbered from 0 to 100, are brought opposite an index, *i*, the distance from the surface of the sleeve to that of the movable arm is either equal to the number of millimeters read by the index, I, or a unit greater than such number.

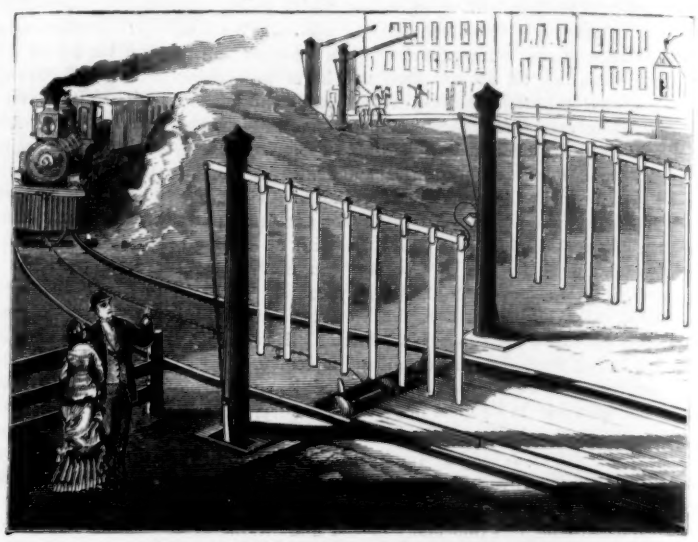
When another division of the disk is opposite *i*, the number corresponding thereto indicates the number of hundredths of a millimeter that must be added to the reading made at I, in order to have the actual distance of the two arms; P, a set screw, acting on a collar placed at the base of the micrometer disk and centered on the axis, *a*. This permits of fixing the disk in any position whatever.

NEW RAILROAD SIGNALING APPARATUS.

We give an engraving of an improved signaling apparatus designed to give at railroad crossings an unmistakable indication of the approach of a train.

The illustration shows the apparatus in its normal condition in the distance, while in the foreground it is in signaling position, having been operated by the approaching train.

The invention consists of a series of rock shafts secured below the railroad rails parallel with the cross-ties, the shafts being provided with levers that project upward in position to be engaged by the locomotive, and the rock shafts being connected with the signaling apparatus by wire ropes or rods, the signal arm is thrown down at the crossing as the locomotive passes over the lever of the rock shaft. There are three rock shafts to each signal, one connected directly with the signal arms by means of short rods, the others placed at opposite sides of the signal and at a considerable distance from it.



ELY'S RAILROAD SIGNALING APPARATUS.

A train approaching the apparatus strikes the first lever, thereby partly rotating its rock shaft, which, by its wire rope or chain connection, turns the middle rock shaft connected directly with the signal. This throws the signal arm into a downwardly inclined position, when the pendants, which were bunched together near the post, slide downward along the signal arm and arrange themselves at equidistant points along the length of the arm, the distance between them being regulated by a cord attached to the top of each.

This device forms a yielding barrier that is plainly visible, and at the same time will give way should a frightened animal try to pass through it.

This barrier is not intended to close the roadway entirely, as it extends only about two-thirds the way across the road. When the locomotive reaches the lever connected directly with the signal, the signal arm is raised, and the pendants slide by their own gravity downward toward the post which supports the arm.

The operation of this apparatus is the same when approached from either direction; and it not only gives the visible signal, it gives an audible signal by means of the bell hung by a very flexible spring at the end of the signal arm. When the arm drops this bell rings for a considerable time. Further information in regard to this useful invention may be obtained by addressing Mrs. Horatio Ely, Jr., Black Mills, Monmouth Co., N. J.

Tunnels on the North Pacific.

Chief Engineer Anderson, of the Northern Pacific Railway, gives the dimensions of the tunnels on that line as follows: At the Big Horn, 1,100 feet, now completed; through Bozeman Pass, 3,600 feet; at the Mullan Pass, near Helena, 3,650 feet; at the Mullan grade, 500; and at the Blackfoot, 500; in all 9,350 feet. The heaviest work is at the Bozeman and Mullan Passes.

To Plug Leaky Boiler Tubes.—If the leak is near the head, fit and drive in a short ferrule; if the leak is in the body of the tube where a band cannot be bolted around it, take it out and put in a new tube.

THE HISTORY OF A GREAT INVENTION.—THE GIFFARD INJECTOR.*

Giffard has recently died.† He was a great inventor, and every one has interested himself in the details of his life and with the recollection of his labors. We believe that it will prove of interest to all to learn the history of the discovery that has immortalized his name. The invention of the Giffard injector affords still another instance of the fact that it is always through serious studies, patient preparation, unremitting work, and persistent thought that those results of genius are reached which endow the industrial world with a new process or a new apparatus.

For many men, it would seem to be a sorrow and almost an offense to recognize the merit and superiority of an inventor; and to attribute to hazard and chance the occasion of a great discovery is to cause them genuine satisfaction.

If the inventor has benefited by a chance, by an accidental experiment, he is no more than a man the equal of and like others—a fortunate one of the earth; and people may envy him while esteeming themselves unfortunate in not having had the luck to make a similar "find," just as is envied the possessor of the ticket which drew the grand prize in the lottery, or the miner who finds an ingot of gold.

It is our intention to use Giffard as an example furnishing a new proof of the absolute assertion that if the discovery and appropriation of a material treasure already existing, but for the moment hidden from the eyes of man, can be attributed to accident, to chance, the discovery by Giffard of his great invention, the injector—that treasure that he neither found nor invented, but created—can be attributed only to his genius and persevering labor.

Up to the present time it has always taken a combination of endurance, persevering effort in work, and of inventive genius to endow the world with those wonderful creations that mark an epoch, such as the printing press of Gutenberg, the enamels of Bernard de Palissy, the steam engine of Watt, the mule-jenny of Arkwright, the loom of Jacquard, and the works of Robert Fulton, Philippe de Girard, etc.

I have cited the names of inventions known to all, but, in aid of the assertion that I maintain, the examples are numerous, and all characteristic, from the manufacture of iron by Lord Dudley, in 1621, down to the manufacture of steel by Bessemer, in 1856, and of the Giffard injector, in 1858.

During the course of the year 1849, Giffard had Mr. Flaud construct the high speed steam engine that he (Giffard) had devised, calculated to draw an engine whose arrangements and proportions disagreed with all those ideas that had, up to that time, been admitted and accepted by constructing mechanicians.

Giffard relied on the admitted theory and mechanical formulas, but it was only to deduce from them ideas of surprising boldness. A single example will suffice to demonstrate this, since at that epoch he caused to be constructed and regularly operated a three horse power engine, weighing only 45 kilogrammes, flywheel included, and running with a speed of 3,000 revolutions per minute.

Like many others, I visited Mr. Flaud's shop, in which a 45 kilogramme engine was running a dozen tools, the smallest of which was larger than the engine. What appeared singular, at first sight, was the large size of the bearings or plumber-blocks in which the little steel driving shaft revolved. A connecting rod, also of steel, transmitted to the driving shaft the motion from a piston rod that made 6,000 strokes per minute in traversing from top to bottom and bottom to top the small vertical cylinder that the steam entered.

The bearings employed for the small steel driving shaft were wider than those used on ordinary steam engines running at the rate of 50 revolutions per minute, and with a large iron shaft, 10 to 12 centimeters in diameter.

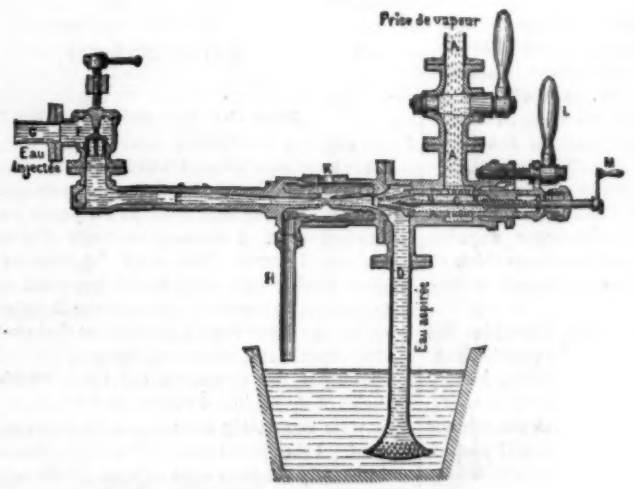


Fig. 3.—SECTION OF A GIFFARD INJECTOR.

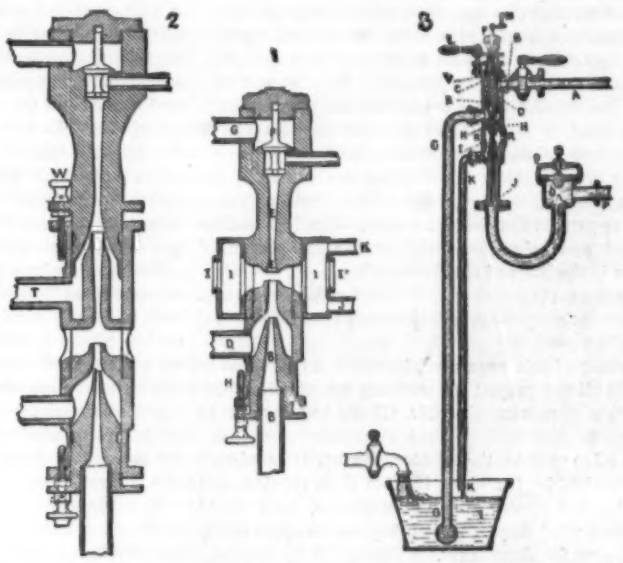


Fig. 2.—FIRST SKETCHES OF THE INJECTOR AND FIRST FORM OF THE APPARATUS.

At my observation Giffard contented himself with showing me, in a copy that he had made from one of our books of the Central School, the formula of the friction whose terms were independent of the surface; and I then understood in what manner he had utilized theory in order to pass to the practice of construction under new and fecund conditions.

The important thing for the builder, as well as for the inventor, was to earn money, since all resources were used up—by Giffard in experiments and the construction of his little high speed engine, and by Flaud in the starting and keeping up of his small workshop.

The want of funds was so complete that it was impossible to obtain, by uniting their two purses, the sum of 100 francs that was necessary to deposit for the patent, the drawings and description of which were all prepared.

It was precisely at that period of time (toward July, 1850) that, while pursuing the theoretic calculations that he desired to make a practical application of, Giffard wrote the *résumé* and the calculations for his feed injector without movable parts, and with conical tubes and free intervals.

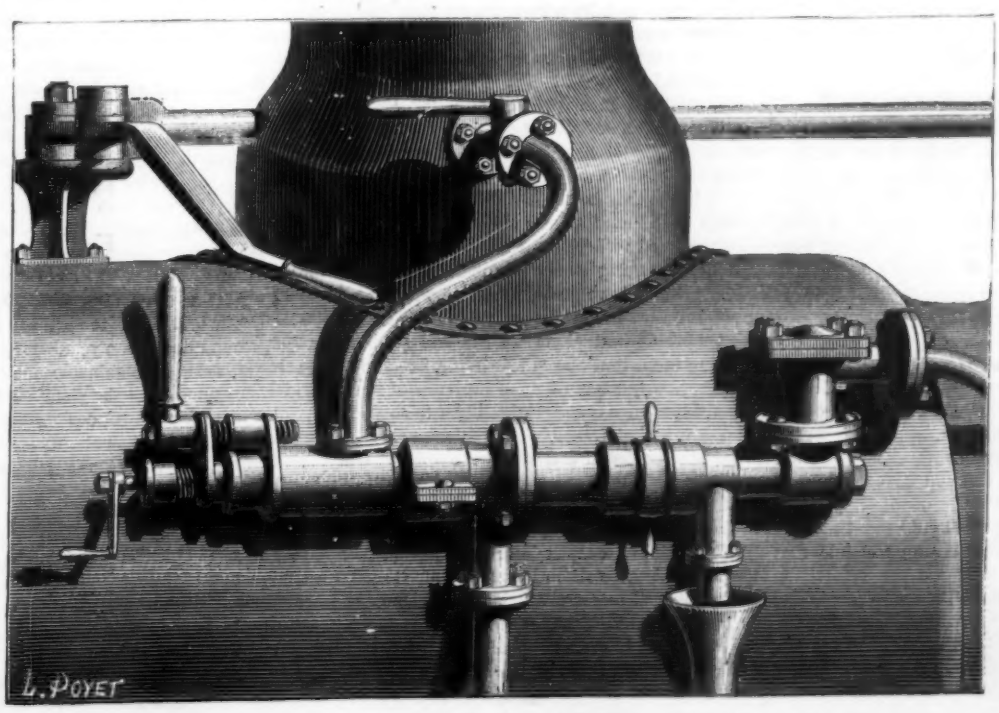


Fig. 1.—THE GIFFARD INJECTOR MOUNTED ON A LOCOMOTIVE.

This apparatus he wished to make an application of to locomotives as a substitute for feed pumps, and to do away with the ridiculous method then in vogue of feeding boilers at the station.

The final calculations for the injector, with geometrical sketches indicating the dimensions, are made on four loose sheets, written in Giffard's own hand; but, as I have just explained, at the dates of July and August, 1850, it was impossible to spend money for making experiments or for constructing a new apparatus. Mr. Flaud did not then believe in the possibility of realizing practically an apparatus the data for which were in contradiction to all the theories of heat that were admitted up to that time.

Under these circumstances the injector made no progress at that epoch. Desiring to first obtain resources, Messrs. Flaud and Giffard took out their first patent, under date of the 9th of September, and under No. 10,441, for a *system of high speed steam engine*—that is to say, for new arrangements in the engine which was practically experimented with in 1849, under conditions as exaggerated as possible as to speed.

But in 1850 Giffard had met some engineers of the Central School to whom he had communicated his ideas on aerial navigation, and who had become enthusiastic over this new application of the steam engine. His studies were pushed with activity, as were his experiments, and, on the 20th of August, 1851, under No. 12,226, he made application for a new patent for France for the *application of steam to aerial navigation*.

I should say that, up to the end of his life, the direction of balloons under certain given conditions was the constant object of Giffard's labors, and he was absolutely convinced of the possibility of realizing such aerial navigation, which he was proud of having been the first to experiment with practically; for, in 1852, he had ascended alone to a great height in the atmosphere by means of a balloon elongated like a ship and moved by a remarkably light high speed steam engine. In view of the scanty means at his disposal, this attempt had all the success that the inventor could dare to hope for, and if, at that time, he had been seriously aided, the question to-day would have been more advanced. But of his three colaborers two had suddenly died, David and Sciama, and the third, Cohen, had used up his financial resources.

Persevering in his researches, Giffard wished to try again under better circumstances his great experiment in aerial navigation; so, with this end in view, he made numerous balloon ascents, studying with care the means of constructing light steam boilers; of manufacturing pure, and consequently lighter, hydrogen; and all the minutest details in regard to the numerous means that might remedy the defects that he had observed in his first experiment.

It was in a new patent (No. 24,057) of July 6, 1855, that we embodied the improved system of aerial navigation whose elements he had combined; and, on the 25th of November, 1856, we likewise indicated the practical processes which permitted of the manufacture of pure hydrogen. However, Giffard's resources were still very modest, and it was only after having studied out and had patented a regulator valve, in 1857, with Flaud, whose shops had grown, that he took up again the problem of feeding boilers, and obtained a patent (February, 1858) for a system operating by centrifugal force.

At this time it was a question of finding a boiler feed apparatus without any particular reference to very high speed engines. The plan was executed in Flaud's shop by means of two small turbines united on the same axis; the one, re-

*Emile Barrault, in *La Nature*.

†See portrait and biographical sketch in our issue of August 5, current volume.

ceiving the steam on its circumference, acting as a motor, and the other, receiving the water at its center, acting by centrifugal force. To feed a hundred horse power boiler it took an apparatus of only 10 centimeters diameter, weighing 8 kilogrammes.

The little feed apparatus was very simple and ran with regularity. Orders began to come in in numbers, and Mr. Flaud was full of confidence in the industrial success of it; but there was another inventor who held a valuable patent for a turbine whose arrangements resembled those adopted by Giffard. This patentee, Girard, a distinguished hydraulic engineer, had never thought of the combination invented by Giffard, or even of the feeding of boilers. He was a very positive person, a man who had suffered much, and in the new application devised by another he hoped to find something to make up for his numerous troubles; and he, therefore, was desirous of working up, to his own exclusive profit, what many manufacturers would necessarily have seconded. In the face of a claim that was presented with some irony, and under the threats of a lawsuit that he was not in a position to defend, in view of his financial position at the time, Giffard betook himself to his calculations of 1850.

It was May 8, 1858, about one month after abandoning the centrifugal apparatus, that he took out his patent in France for the feed apparatus that bears his name—the first realization of those new scientific doctrines the knowledge of which to-day is the basis of classic teaching.

The annexed cut (Fig. 2) shows, at Nos. 1 and 2, the figures of the patent which represent the injector as seen in sectional elevation.

The perfection of this apparatus, in which no part was in motion, made nil the project of working up the first centrifugal motion apparatus that Mr. Girard had seen fit to seize upon.

For four or five months the injector, constructed as shown in the cut, worked in the shop in Rue Jean Goujon, and was visited by the most prominent engineers, who could scarcely believe what they saw until they had an opportunity of experimenting for themselves.

Before the injector, the only feed apparatus employed for steam engines were four in number, viz.:

1. The *pulsometer*, which consisted of a large and strong vessel that was emptied and filled alternately by maneuvering cocks and valves, and which could be employed for locomotives and steamboats.

2. The *pump*, actuated by the engine, and the vagaries in the operation of which were numerous, since nothing more was necessary to stop the play of the valves than the presence of the smallest foreign body, or even of sour water. Moreover, the working of the pump required a certain amount of force from the motor that diminished its power; and, in addition, freezing and frequent repairs were to be apprehended.

3. The *donkey engine*, or pump actuated by a special engine, a costly apparatus that consumed much steam and took up considerable room, on locomotives for example.

4. The *reservoir*, which allowed water to enter the boiler through the action of gravity, thus necessitating its being placed at a great height.

During the year that followed the obtaining of the patent, numerous practical improvements brought the injector to a state of perfection in working, and the certificate of addition in which I embodied all these improvements bears date of May 7, 1859.

Fig. 2, No. 3, shows the drawing that was annexed to the certificate of addition of 1859, and represents in section the improved and final arrangements of the feed apparatus of Giffard's invention.

I have said that mechanical builders and engineers had considered that it was impossible for the injector to work; so, when the first application of it was made on the locomotives of the Railway of the East, care was taken to leave the feed pumps in place so as to be able to use them if there should be need. But it was not found necessary to have recourse to them; for it was ascertained by experiment that the action of the injector was easy and sure, and, at the end of a fortnight, the feed pumps were removed. Fig. 1 represents portion of a locomotive engine with its injector.

It will be still remembered at the present time what surprise and astonishment followed the first applications made by M. Dupuy de Lôme, the director-general of naval constructions, who was one of the first, in 1858, to negotiate for the introduction of the injector into the navy.

Communications were received by scientific societies from distinguished men whom they had charged with the duty of making in their behalf an attentive study of this apparatus, which was attracting the attention of all competent men by its originality and the novelty of the scientific principles that it brought in play.

In a report made to the Société d'Encouragement, and which was published in its number for June, 1859, Mr. Ch. Combes, of the Institute, after saying that the injector contained no solid movable piece, added that it was founded upon the principle of the lateral communication of the motion of fluids, and that it utilized "the jet of steam from a boiler for feeding this boiler itself," realizing an industrial application in which "the heat contained in the jet carried along by the steam played the principal role."

In one part of this important paper, Mr. Combes expressed himself thus: "Considered as a feed apparatus for steam boilers, Mr. Giffard's apparatus is, undeniably, the best of all that have been or can be employed, as it is the simplest and most ingenious of them. If we suppose, in fact, that conformably to ideas hitherto held, the quantity of steam contained in bodies is preserved in its entirety through the changes in volume that these undergo, independently of the quantities of motive or resistant power that are the consequence of such changes, it is clear that the operation of Mr. Giffard's apparatus will give rise to no loss of heat except that due to radiation or to contact of the boiler and its appendages with the surrounding medium. The supply will take place gratuitously. If, conformably to the more rational principles of the new dynamic theory of heat, we admit that heat is converted into motive power, and reciprocally, so that all motive or resistant power, all the live force developed or destroyed in the changes of volume or state of the bodies, be accompanied by a disappearance or a production of equivalent heat, the quantity of heat expended in the operation of the Giffard apparatus will be (setting aside losses through radiation or contact with the surrounding medium) precisely equivalent to the motive power that corresponds to the elevation of the quantity of feed water from the reservoir that holds it, and to the forcing of it into the boiler under the pressure that exists therein. We are, then, justified in saying that the Giffard injector is a feed apparatus which is theoretically perfect for steam boilers. The inventor has proved that the dimensions can be so arranged that it will work under material conditions that nearly reach such theoretic perfection."

Testimonials in regard to the importance of this invention are numerous from all sources, but it will suffice to mention that the mechanical prize (Montyon prize) was awarded Giffard by the Academie des Sciences at the competition of 1859, without his having taken any steps to obtain it or even made any communication.

I shall not, at present at least, speak of the difficulties that the invention met with later on, for I desire to remain faithful to the title of this article and limit myself to the history of the invention.

Reduced to its simplest terms, the invention of the injector is based upon the idea that the steam boiler should furnish directly the power necessary to supply itself with water.

To realize such an idea, a section in the boiler causes a jet of steam to issue, which passes into a conical tube that leads it in such a way as to suddenly come in contact with the sucked up liquid, in order to bring about by a sudden condensation the transformation of the live force.

As a consequence of the conversion of velocity into pressure, the water is carried to a valve in another section of the boiler, and the dimensions of which are smaller than those of the aperture that allows the steam to escape. A system of two cones, one convergent and the other divergent, permits of regulating through the former the convergence of the fluid jet, the form of which is so modified by the divergent cone as to facilitate its re-entrance into the boiler in spite of the pressure existing therein.

Such is the apparatus as arranged on all locomotives to feed their boilers.

Fig. 3 shows in longitudinal section an injector in position; and this, with the description appended to this article, will be sufficient to allow the working of the apparatus to be understood.

And now we may sum up the new scientific principles, four in number, that are combined and brought into play in this remarkable invention, along with principles and mechanical methods already known:

1. On contact with the water the steam condenses and communicates to it its velocity.

2. Condensation can only take place if the water is notably colder than the steam; and it is therefore necessary that the water, already heated by the condensation of a part of the steam, shall be put in contact with uncooled steam.

3. The pressure of the jet obtained by the condensation of the steam may be notably greater than that of the motive steam.

4. A liquid may be thrown to a distance from a stationary ajutage within another one also stationary, communicating with a reservoir wherein there is pressure, without any loss of liquid occurring as a consequence of such transmission.

I hope that I have given proof of what lies close to my heart, and furnished enough details to cause it to be understood that Giffard alone was in the position proper for realizing the invention of the injector, because he had slowly and laboriously amassed those treasures of science and individual experience that permitted him to succeed.

He was an indefatigable and patient worker, who recorded in his note books all that he saw, observed, and calculated; and it was thus that, at an opportune moment, he was enabled to sum up in one powerful effort the long prepared elements of the problem that he had proposed to himself in youth.

When Giffard escaped from the Bourbon College to go to the Saint Lazare station, it was in order to make a study of the running of locomotives, and to become exasperated at seeing them too often expend their power in ridiculous movements made for the sole purpose of bringing to the boilers the water necessary for the supply of their strong steam engines.

The injector was not a lucky find, the result of an accidental experiment, the flash of an inspiration of genius; for Giffard calculated (as did Newton over the fall of the apple) from the experiments made by him in 1850 and after. It is we who to-day benefit by the fruit of the persevering and conscientious efforts of this immortal man, whose life was well employed for humanity.

DESCRIPTION OF FIG. 3.—A, steam pipe communicating with the boiler; B, another pipe receiving steam from the preceding through small holes, and terminating in a cone; C, screw rod, cone-shaped at its extremity, actuated by the winch, M, and serving to regulate and even intercept the passage of the steam; D, water suction pipe.

The water that is drawn up introduces itself around the steam pipe and tends to make its exit through the annular section at the conical extremity of the latter. This annular section is increased at will by means of the lever, L, which acts upon a screw whose office is to cause the pipe, B, and its system to move backward or forward. E, diverging ajutage, which receives the water injected by the jet of steam that condenses therein at I, and imparts to it a portion of its speed, in proportion to the pressure of the boiler; F, a box carrying a check-valve to keep the water from issuing from the boiler when the apparatus is not at work; G, a pipe that leads the injected water to the boiler; H, purge or overflow pipe; K, sight hole, which permits the operation of the apparatus to be watched, the stream of water being distinctly seen in the free interval.

Correspondence.

Does the Bee Injure Grapes?

To the Editor of the Scientific American:

It has long been believed, and is now almost universally accepted as a fact, that the bee destroys grapes and other fruits. I have watched the little workers for years, and have been loth to believe it. I observed long ago that they never attacked sound grapes. But when defective, or split as the result of a rainy spell, they would then suck out the juices. Being unable to convince others of the harmlessness of the insect in any other way, I devised for that purpose the following experiment, which any one may try for himself.

I placed at the mouth of the hives bunches of several varieties of thin-skinned grapes, and for days, although the bees were constantly crawling over them, not a berry was injured. I then punctured half of the berries on each bunch, and instantly the bees went to work on all so punctured, in a short time sucking them dry. The remainder of the berries were untouched, and remained so until punctured by me, when they in turn were attacked as promptly as the former.

This experiment demonstrates that it is necessary for the grape to have been previously injured so as to allow exudation of juice; otherwise the bee will not molest it. I have not observed so carefully in the case of other fruits, but it is my belief that this is the *modus operandi* in all cases.

Rot, splitting of the grape, injury by insects and birds (in this latitude a small yellowish bird is conspicuous), are the causes that render grapes liable to attack by bees. And when we reflect that the berries thus injured would decay, it will be seen that the bee actually saves to us what would otherwise be lost, by storing it up as honey.

I have been hurried into this communication by observing that in some quarters legislative action is about to be taken against an insect which I believe closer observation will demonstrate to be not only innocent of harm, but productive of good.

T. T. ROBERTSON, M.D.

Winnsborough, S. C., Aug., 1882.

Heavy Locomotives.

To the Editor of the Scientific American:

In your publication of June 3, you say, in answer to correspondent F. A. S., that the heaviest of the usual class of locomotives is 55 to 60 tons.

The following is the weight of one of the bank engines used for overcoming the steep grades on parts of the Santiago and Valparaiso Railroad. This weight includes water but no coal: Engine, 46,742 kilos; tender, 28,387 kilos; total, 75,129 kilos, equal to 73·94 tons of 2,240 pounds.

O. BOWKER,
Engineer Antofagasta Railroad.

Antofagasta, Chile, July, 1882.

The World's Iron Product.

A critical estimate of the annual iron product of the world shows the yield to be close upon nineteen and a half million tons a year. Statistics for the more important countries are obtainable as late as 1881. For the others it is assumed that the yield has not fallen off since the latest figures reported. Under "other countries," in the table below, are included Canada, Switzerland, and Mexico, each producing about 7,500 tons a year, and Norway, with 4,000 tons a year.

	Year.	Gross Tons.
Great Britain	1881	8,377,364
United States	1881	4,144,254
Germany	1881	2,853,400
France	1881	1,866,438
Belgium	1881	622,288
Austro-Hungary	1880	448 685
Sweden	1880	399,628
Luxembourg	1881	289,212
Russia	1881	231,341
Italy	1876	76,000
Spain	1873	73,000
Turkey	—	40,000
Japan	1877	10,000
All other countries	—	46,000
Total		19,487,610

The first four countries produce 88·4 per cent of the world's iron supply; the first two, 64·3 per cent; the first, 43 per cent. The chief consumer is the United States, 29 per cent; next Great Britain, 23·4 per cent; these two using more than half of all.

AMERICAN INDUSTRIES—No. 84.

THE MANUFACTURE OF FILES—THE NEW AMERICAN FILE COMPANY.

The engraving on our first page represents the outside and portions of the interior of one of the best equipped file manufactories in this country.

The New American File Company, of Pawtucket, R. I., was established only nine years ago, but they have already achieved a remarkable success, having a capital of $500,000, and employing two hundred hands. The works, originally of wood, are being rebuilt with brick. The machinery of the manufactory is driven by a 250-horse-power Harris-Corliss engine, a smaller engine being used for the machine shop.

Mr. Stephen A. Jenks is president and treasurer of the company, and Mr. C. M. Fairbanks is agent. The company is ably managed, and all the branches of its business are conducted with much success.

Some idea of the manipulations necessary to produce a file may be gained by the notes of a run through the manufactory of this company. The steel is made for the company in lengths that will cut without waste. The bars come from the steel makers at the proper widths and thicknesses for the blanks from which the files are made. Being cut to lengths, they are forged—the tangs and the taper, where taper is necessary to the shape of the file—and for this forging there are employed at this establishment twenty-one power hammers, comprising eleven Bradley hammers, six ordinary trip hammers, three Belden hammers, and one Grant hammer. These hammers have a capacity of 1,050 dozen per day.

But in addition to this power-hammer forging, there is a large amount of hand-hammering work. Most of the small files—especially the three-cornered files—are made by hand-work in dies fixed in ordinary anvils.

After the forging, the blanks must be ground for cutting. Now, this process of grinding is not merely intended to even the sides of the file or determine its edges; but it means a reduction of the surface in connection with the removal of the oxidation or scale. It is impossible to cut good file teeth through the scale of rolled or tilted steel. All of the exterior surface of the best forged or rolled steel must be removed before the chisel can raise the tooth of the file.

And yet in the grinding the exactness is not sufficient to satisfy the requirements of this company: for some purposes it is necessary to dress the file blanks in a filing machine that draw-files the blanks to the perfection of a surface plate. And although the grinding process is as near perfection as possible, leaving the surface with a variation of less than one one-thousandth of an inch, it simply cuts off the outside of the steel and does not make an absolutely perfect surface.

The principal attraction in the establishment of the New American File Company is their large cutting shop, where no less than eighty-five machines are busy in cutting the teeth in files. The room is shown in the central figure of the engraving. The process of file cutting by machinery is modern. For many years the possibility of machine-cut files was sneered at. It was asserted that no machine-work could supersede the hand-work of the skilled file cutter. Possibly this is a fact to a certain extent; for it is a fact that special sizes and forms of files must now be cut by hand, as also rasps and particular forms of sides, faces, or edges.

The Bernot patent, under which the machines of this establishment are worked, comprehends all that is possible in machine-cutting of files; and it is carried to its ultimate by this company. The machine is very simple; but its simplicity comprises its value. The file blank lies on a lead bed, and is fed by ratchet wheel and pawl, giving it intermittent forward movements, between which the chisel makes its cut. The chisel comes down with a springing stroke, very much like that of the human arm, the spring being given by a series of leaves of sheet steel, the number of the leaves and the thickness of the entire spring being adjusted to the style of the file to be cut. In the cutting of very fine files the spring for the blow of the cutter is quite light, being simply a coiled wire spring. These cutting machines give from 600 to 900 blows per minute, and cut over the surface of a file with such surprising rapidity that the eye wearies in watching the process.

The steel used in the chisels in the machines and by the hand workmen is made specially for the purpose, and costs, as imported, forty-eight cents per pound. The steel for the files is American; it having been found by actual tests that the American steel is preferable to any foreign product, as being more even and reliable.

By absolute and uninterested tests, it has been found that the machine-made file is really superior to the hand-made file, and large manufacturers acknowledge the fact by their patronage of this company, the production of which is about 1,000 dozen per day. Perfect order and good management pervade this establishment, which is a model in its line.

Irritating Effects of Stings in the Animal and Vegetable Kingdom.

BY PROF. AUGUST VOGEL, OF MUNICH.

It is well known that the effect of a stinging nettle on the skin agrees very closely with the sensation produced by the sting of a bee or wasp. But the great similarity is not limited to the feelings it causes, but, what may not be so well known, the cause of the irritation produced on the skin is essentially the same. It may be considered as definitely settled that formic acid is present in the poison sac of the bee sting, in the so-called bee poison. The same corrosive acid also occurs in the sting of the nettle. Some species of caterpillars have formic acid in some of their hairs, which they seem to be able to shake off at will, and when a person touches such a caterpillar the poison penetrates the skin wherever it is moist and causes burning, itching, and inflammation. These poisonous members preserve their irritating powers even after the death of the worm. This accounts for reliable statements that visitors to collections of caterpillars have suffered from exanthematous eruptions on the neck. "Many hairy caterpillars cause itching and burning of the skin when touched, and sometimes it gives rise to swelling and redness. This depends on the fine hairs, which produce the same effect when they float around in the air. Many ladies who visited the caterpillar room of the naturalist Reaumur had a breaking out on the neck."

In the sting of the bee, wasp, hornet, etc., a minute drop of a transparent liquid may be observed on the sting, and is called "bee poison" (formic acid). It penetrates into the wound produced by the sting, and causes the well known effects. It would, however, be a great mistake to assume that the only object of this is to increase the effect of the sting, that is, that it serves only to injure. It has a far more important purpose, namely, to prevent fermentation and decay. The celebrated bee cultivator, Holz, reports that in his long experience with honey, that which came from what are called "rancorous swarms" (boshaft) had peculiar properties. It always had a bitter, harsh taste, and its smell was sharp too. How can the character of the swarm affect the smell and taste of the honey they gather? We know that bees, when they are disturbed, run out their stings, on the end of which may be seen a tiny drop. This little drop, as we have already said, is bee poison, or formic acid. When the disturbance is at an end they draw in their stings again, but the little drop of liquid does not go back with it, but is wiped off on the comb, and sooner or later gets mixed up with the honey. This explains how honey from such excited bees must taste and smell sharper than from peaceable bees. Excitable bees will rub off this little drop of formic acid more frequently than other bees; perhaps a larger drop is formed by nervous bees than by those that are not nervous, and hence the honey is richer in formic acid. This acid is never absent in genuine honey, but the amount differs. This contamination is not only uninjurious but very useful, in fact necessary, for it keeps the honey from spoiling; we know, indeed, that purified honey, from which the formic acid has been removed, very soon ferments, while unpurified honey will keep unchanged for years. Nature furnishes the bees with this knowledge instinctively, and therefore they do not carry this drop of formic acid away out of the hive. Bee connoisseurs assure me that the bees add it to the nectar which they collect that is free from it so as to make it keep, and they do this in places where they are not disturbed too.

Bee stings are often spoken of in agricultural and popular papers as a remedy for rheumatic affections, and numerous cures are adduced to prove it. If the formic acid that accompanies the sting can be looked upon as the principal agent in the cure, it would be worth while to try the experiment of rubbing the spot with this acid or injecting it under the skin, so as to avoid the somewhat inconvenient method of applying live bees.

Two hundred years ago formic acid was made from the brown wood ants, by triturating them with water and distilling it. The acid liquid was used to irritate the skin. The reddening of the skin, by using baths of pine leaves, is also due to the action of the formic acid. The anti-fermentative action of formic acid has also long been recognized.

As regards the irritative action of stinging nettles and other similar vegetables, it depends, as already stated, on its formic acid. The point of the nettles is brittle as glass, and by the lightest touch penetrates the skin and breaks off, pouring out its acid and causing the burning sensation.

In this little notice frequent mention has been made of formic acid. In conclusion it may be stated that it gets its name from the ant (*formica*), because it was *first* found in them. If it had been found first in the bee or nettle it would have received another name. If an ant runs over a piece of blue litmus paper he will leave a red streak. Put a stick in an ant hill and they will squirt strong acid on it.—*Humboldt.*

Poisonous Maple Sirup.

R. B. Warder, in a paper at the February meeting of the section of Chemistry and Physics of the Ohio Mechanics Institute, stated that information was received from Mr. Stanley Hatch, of Riverside, that some maple sirup, which had been made in a pan of galvanized iron, had an unpleasant taste. This led to a suspicion of contamination with zinc. A committee was appointed to examine the matter, and from their report we take the following:

The so-called "galvanized iron" consists essentially of sheet iron coated on both sides with zinc. A film of tin is sometimes deposited upon the iron first, in order to secure a more perfect adhesion of the zinc; but no danger was apprehended, except from the zinc itself. The pans are usually soldered so that no edges of iron are exposed; but the solder itself renders the surface non-homogeneous, and may thus promote galvanic action and corrosion. Manufacturers and dealers in sugar-making apparatus inform us that galvanized iron evaporating pans were introduced about the year 1859, and that they are now in general use, no complaints of corrosion or zinc poisoning having come to their notice. This material is much preferred to sheet iron, which rusts (if not painted) during the long interval from one season of use to another. Mr. C. G. Hampton, of Detroit, Michigan, informs us that galvanized iron is nearly always used for the evaporation of maple sap, except when the same pan is also to serve for the concentration of apple juice; in this case copper pans are used. It is stated that galvanized iron will do service for ten seasons, and that the zinc coating is not worn through, unless by excessive scouring.

Our own analyses of the samples received from Mr. Hatch led to the following results. The sap when examined had distinct acid reaction. By titration with caustic soda and phenol phthalein (with prolonged boiling to expel CO_2) we found that a liter of the sap would neutralize 28 milligrammes NaOH, corresponding to 42 milligrammes acetic acid. The sirup was rich and viscous, of dark color, having a specific gravity of 1·732 at 22° C., having the characteristic maple taste, but leaving an unpleasant astringent after taste, similar to that of zinc salts, yet not so pronounced as to render the sirup wholly unpalatable. This also had acid reaction; and titration indicated 300 milligrammes (calculated as acetic acid) to 1 K. It gave 1·38 per cent of white ash. We may readily see from the experiments of Wagner and Snyders that such acid liquids, especially at high temperatures, could not fail to have an appreciable action upon the zinc. The presence of this metal in the sirup was clearly shown by qualitative tests, both wet and dry. Unfortunately, the material at our disposal was not sufficient for the accurate estimation of zinc; but a single determination gave us about 0·1 per cent of ZnO. This amount, calculated as sulphate, would correspond to 6·14 grammes (95 grains) of the crystallized salt per liter. Such an amount must certainly be regarded as unwholesome, though perhaps not dangerous, if the sirup is used in moderation.

CONCLUSIONS.

1. Galvanized iron evaporating pans have been used in sugar-making (including maple sugar) for more than twenty years. This material seems to be generally preferred to any other.

2. Even pure water, in presence of air, is known to have a distinct solvent action upon zinc, at the ordinary temperature. This action would doubtless be much increased, in the evaporation of sap, in consequence of the high temperature and the salts found in the sap.

3. In ordinary cases, this action is practically so slight that the zinc dissolved can not be considered a source of danger. If the sap is allowed to become sour, however, the sirup may take up so much zinc as to become unsalable and unwholesome, even if not absolutely dangerous.

4. The danger of contamination may be diminished by promptly evaporating the sap, before fermentation or souring begins to take place. Addition of a little lime, or other alkali, may sometimes be helpful even for maple sap.

5. When the pan is new, it may also be desirable to form an insoluble film over this surface by first boiling a solution of sodic phosphate, or even hard spring water, to diminish the action of the sap or cane juice.

[It would appear from the foregoing that all maple sirups and sugars now put on the market are more or less poisoned with zinc salts, and it is therefore evident that some other material than galvanized iron should be used for the evaporating pans. There is here a pressing need for a new improvement.—ED.]

Testing Drains.

One very notable instance of the value of the smoke test in discovering imperfect joints is given by Mr. G. H. Stanger, C.E., in his treatise on "House Sanitation." He there says: "When making a first inspection at the Wolverhampton General Hospital, and testing with the smoke test, by forcing smoke up the drains with a small fan blast, and thus finding out the untrapped inlets and leaky joints within the building, we discovered, among many other defects, smoke issuing from a pipe casing in the corner of one room. On examination it was found that an inch overflow pipe from a disused cistern had been cut off by some plumber, anxious, perhaps, not to contaminate the water supply, and the end communicating with the sewer left perfectly open into the room. On retesting to prove the work where the alterations were completed, one part of the basement was filled with smoke, and it was thus discovered that a temporary connection put in during the alterations had not been removed." Testing, as Mr. Stanger points out, is absolutely necessary. The work should be tested both during the work and after it is done; but, unfortunately, no one ever thinks of testing drains, unless, indeed, the plumber himself. Very few architects ever trouble themselves about the matter, and, in the absence of inspectors, our plumbing details are left entirely to the honesty and mercy of the workmen employed. It is full time tests of the capabilities of our journeyman plumbers were instituted.—*Building News.*

Drainage Operations in Florida.

The Florida Land Improvement Company's canal was completed August 23, to Lake Kickpochee, a large lake within three miles of Lake Okechobee. When the lake was tapped an immense body of water poured down the Caloosahatchee River. The drainage of this region is expected to bring into cultivation some millions of acres of fine sugar land.

Pneumatic Drainage.

A new system for the protection of houses from the infiltration of sewer gas and the disposal of town sewage has been introduced at Paris and Lyons by M. J. B. Berliez, civil engineer, and former director of the Compagnie des Vidanges, of Lyons. An illustration of this new system can now be seen in working order at the barracks of the Pépinière, Boulevard Malesherbes, where a thousand soldiers are quartered, and with the permission of M. Berliez we were able to examine every detail of the process. Underneath the closets the old cesspool has been emptied, thoroughly cleaned, and converted into a cellar. Here we found M. Berliez's apparatus. From each closet above a pipe communicates with an iron cylinder or drum. Within this first receptacle there is an iron basket which will retain a hard substance, such as a brush, or even an infant if thrown down the drain. The detection of crime is thus facilitated, and the obstruction of pipes rendered impossible. A portable handle, affixed from the outside, is used about once a week to impart a strong rotary motion to this basket; the presence of any hard substance is then detected by the sound, and any accumulation of softer substances macerated and driven out

From this first receptacle, and by natural gravitation, the liquefied sewage flows into a second iron receptacle placed close at hand, within a yard or so. A large ovoid floater occupies the greater part of the space within, the pointed end fitting hermetically an opening at the bottom, where the pneumatic suction keeps the floater in its place. It is not till the receptacle is almost full of water that the floater is able to disengage itself from this suction, and, rising, enables the sewage to escape by passing under the floater into the pipes, where the pneumatic suction carries it away. This suction is produced by a steam engine situated in the suburb of Levallois-Perret, and the iron pipes, placed within the main sewers, communicate not only with the Pépinière barracks, but with several private houses, and with a depot at the Place de la Concorde, where the contents of many cesspools are brought and emptied. The total distance is 4,600 meters. It is, therefore, on an extensive scale that the experiment has been tried, and so far has worked well, giving rise to no sort of nuisance, and instead of allowing sewer gas to ascend house drains, drawing it, on the contrary, away.

It is proposed to place these apparatus under all the houses of Paris instead of cesspools; to draw by pneumatic action all the sewage to depots situated in the open country outside Paris, and there pump it forward distances varying from ten to fifty miles, where it may be used either to irrigate farms or be precipitated and converted into solid manure. It is calculated that the sale of this manure and an annual tax of £2 8s. for every house where the system is applied will cover working expenses and yield a large profit. This tax would be an economy on the present cost of emptying cesspools, and the sanitary advantages secured would be an inestimable benefit. The principal objection to the system, so far as its application to towns such as Paris is concerned, rests in the fact that the iron used for the pipes must corrode under the action of sewage matter, and the slightest leakage would cause a total collapse of the whole system. Careful, constant supervision and prompt repairs would be indispensable. Then, the avoidance of nuisance depends on the frequent usage of the closets, as fermentation would set in if the receptacles were left half full for a few days. Families leaving home would have to carefully flush their closets the last thing before their departure; for though each house would be thoroughly protected from sewer gas, it would not be protected from any noxious gas arising within the receptacles. Fortunately these receptacles are very small, and must, in ordinary households, be frequently and automatically emptied during the day; so that, generally speaking, there would be no time for mischief to arise.—*Lancet.*

Detection of Lead in Tinfoil.

A drop of concentrated acetic acid is let fall upon the suspected leaf, and a drop of a solution of potassium iodide is added. If there is lead present there is formed in two or three minutes a yellowish spot of lead iodide. Kopp moistens the leaf to be examined with sulphuric acid. If the tin is pure the spot remains white, but if lead is present there is formed a black spot.

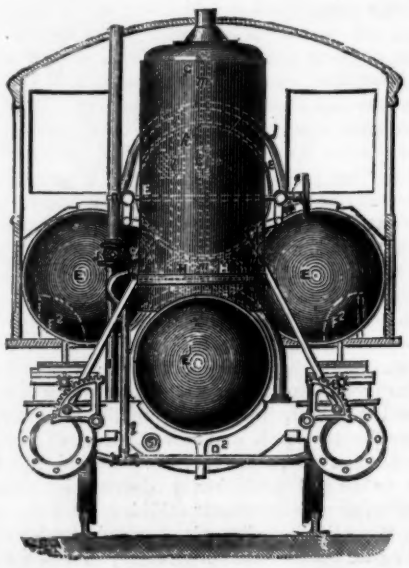
Tannin Soap.

Cocoa-nut oil, 18 lb.; Solution of soda (38° B.), 9 lb.; Tannic acid, ½ lb.; Alcohol, q.s.; Balsam of Peru, 1 oz.; Oil of cinnamon, ½ oz.; Oil of cloves, ½ oz. Saponify the cocoa-nut oil with the solution of soda, then add the tannic acid previously dissolved in alcohol, and add the other ingredients.—*Seifenfab.*

EXPERIMENT WITH AN AIR LOCOMOTIVE ON THE ELEVATED RAILROAD.

In October last an interesting experiment with the Hardie air locomotive was tried on the Third Avenue Elevated Railroad, a run being made from the 128th street station to 42d street and return. The air pressure at the start was 580 pounds per square inch, and the pressure on the return, after a nine mile trip, carrying three cars, and stopping at every station, was 115 pounds. We give herewith the best representation of the engine that has come to our notice, and furnish detail views that will afford a good idea of the working parts of the machine.

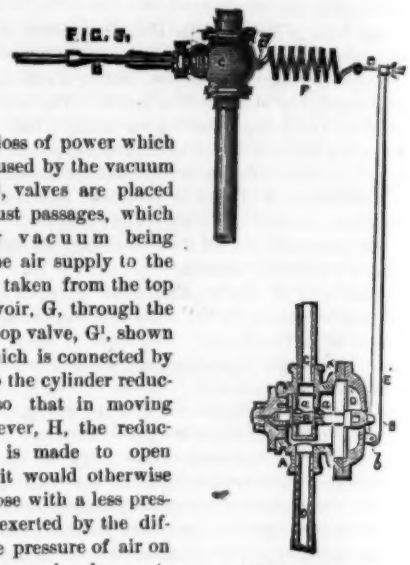
FIG 2



END ELEVATION OF AIR LOCOMOTIVE.

Fig. 1 is a perspective view, and Fig. 2 shows the position of the four air reservoirs, E E E E¹, the lowest one, E¹, running the entire length of the engine, its dished end being seen projecting beyond the cab frame. This reservoir is supported by the cylinder saddle, D², to which the bar framing is secured, while the other reservoirs are supported by brackets, bolted or riveted to the lower reservoir and frame. The reservoirs are all connected by pipes, *j k*, and the air passes from them through a reducing valve, *l*, into the bottom of a small boiler in the cab, the water of which is kept at boiling point, the design being not to mix steam with the air, but to heat and moisten it by contact with hot water. The reservoirs, E, have a capacity of 460 cubic feet, to which air is originally supplied at 600 pounds per square inch. The working pressure in the cylinders is 100 pounds to 180 pounds, and it has been found that when using the air expansively while running, *i. e.*, with a quick cut off, the expansion is sometimes so rapid that toward the end of the stroke the pressure in the cylinders is less than the external atmosphere; to obviate the loss of power which would be caused by the vacuum thus created, valves are placed in the exhaust passages, which prevent any vacuum being formed. The air supply to the cylinders is taken from the top of the reservoir, G, through the throttle or stop valve, G¹, shown in Fig. 3, which is connected by a lever, E, to the cylinder reducing valve, so that in moving the throttle lever, H, the reducing valve is made to open earlier than it would otherwise do, and to close with a less pressure than is exerted by the difference in the pressure of air on the diaphragm and valve seat. The two cylinders are connected by a pipe, through which, and the pipe, *q*, compressed air passes to the boiler, G, thence to two small reservoirs, H H, when the cylinders are used as air pumps, drawing their supply from the atmosphere, and making use in this way of part of the energy needed to retard the train going down hill or coming to a standstill. This arrangement proved to be so successful that no other brakes are required on the engine. The valve gear is shown in Fig. 5 and in the perspective view; the wheel, *e*, by levers, J K, moving the geared segments, I—which rotates the small toothed wheels, *a*, when the cut-off valves, D¹, on the spindle are either drawn together or apart, they deriving their motion from a lever, G, coupled to a crosshead by link, H. The cylinder saddle, D², Fig. 2, is made hollow and forms an exhaust chest, from which extends the exhaust pipe, I, with check valve, J, and it is also used as a vacuum chamber, when the cylinders are used as air pumps and draw their air supply from it. A hose connected with the coupling, S, Fig. 4, communicates with the vacuum brakes upon the train.

FIG. 3.



PRESSURE REGULATOR.

The main valve is held to its seat when the cylinders are used as compressors by the bridge-piece, D (Fig. 4), connected by an adjusting screw, K, to a diaphragm, L, which just keeps it off the valve when in ordinary work.

When compressing, the supply is drawn through valves, E, and delivered through valves, F, and pipe, *p*, into the small reservoirs previously mentioned. The admission of air to or production of a vacuum in the exhaust cavity of the saddle is controlled by a stop-cock within reach of the engineer. The engine weighs about the same as the ordinary elevated railroad locomotive.

FIG 4.

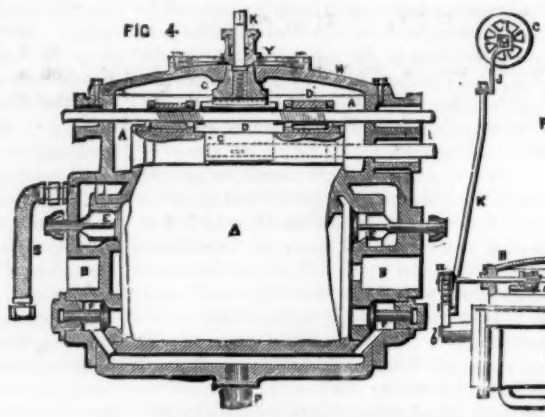
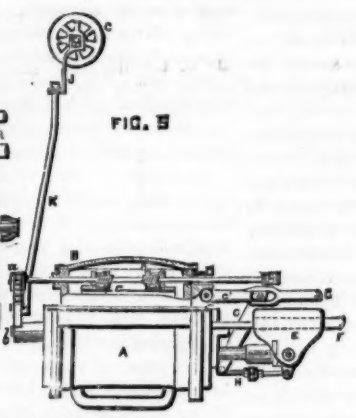


FIG. 5



VALVE GEAR OF AIR LOCOMOTIVE.

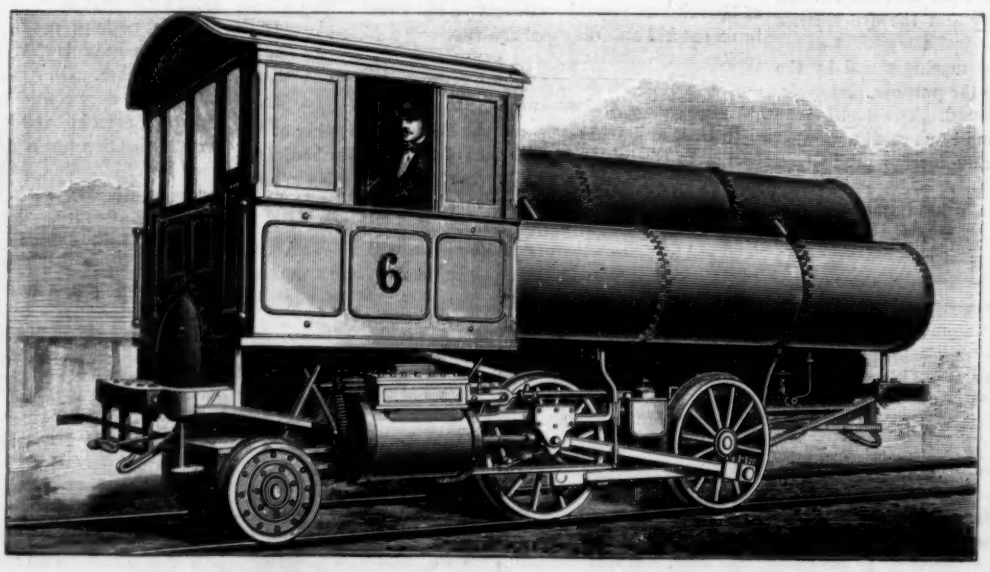


Fig. 1.—AIR LOCOMOTIVE ON THE ELEVATED RAILROAD.

Eruptions of Sulphureted Hydrogen.

A very peculiar phenomenon was observed last December in Missolonghi. On the night of the 15th of December the inhabitants were terrified by the sudden odor of sulphydric acid gas, which was so intense as to interfere with respiration. The next morning the sea was found to be covered with dead and dying fish, and it was seen that an eruption of sulphureted hydrogen gas must have taken place in the small creek of Aitolicon, which is almost completely cut off from the large bay. A similar eruption, accompanied with a light earthquake tremor, followed on the 13th of January, and other shocks were noticed in February. The phenomenon is exceedingly interesting, as explaining the occurrence of enormous quantities of fossil impressions of fish in many formations. At all events, such eruptions must have been of frequent occurrence in former times. It is also noticeable that the impressions of fossil fishes are sometimes filled with scales of pyrites, more particularly in the coal measures, proving that sulphur was present as well as iron.

THE best deep sea sounding apparatus is supposed to be that used by the U. S. Coast Survey.

THE WHITE-FOOTED MOUSE, OR DEER MOUSE.

There are many persons who believe that all mice found in the fields and meadows are simply "house mice which have run wild." On the contrary, they differ so widely that they can not even be admitted into the genus *mus*, to which the common mouse belongs.

The white-footed mouse is the *Hesperomys leucopus* of modern zoologists. Some have seen fit to include in it a subgenus *vesperimus*. It was first described by the eccentric French naturalist Rafinesque as the *Musculus leucopus*. The meaning of the word *Hesperomys* is evening mouse, and of *leucopus*, white foot. This species can be distinguished from the other mice of our fields and woods by the following description: Ears large; tail slender, about as long as the head and body, and thickly clothed with short hairs, no scales being visible like those of the common mouse. Color of the body above, yellowish brown to gray; feet and lower parts of body, white. Tail distinctly bicolor; that is, its upper part is the color of the back, and the lower portion white. Length of the head and body, 2¼ to 3½ inches; length of tail generally equaling the length of the head and body.

The white-footed mouse is agile in its movements, and is an expert climber. The first nest of this species I met with in Pennsylvania was in a hollow stump, and was of a rounded form, and composed of leaves, grasses, and moss. Here they also nest under stone heaps, or logs, or in the ground. In New Jersey it generally builds its nest in thick brier bushes, several feet from the ground. These are made also of moss and leaves, but are interwoven with strips of fibrous bark, probably of the wild grape vine, to make them stronger and more secure. The hole or place of entrance to the nest is always at the bottom. These nests at a first glance may readily be mistaken for those of birds. On shaking the bush or nest you will see the little inmates come forth and rapidly descend to the ground, and conceal themselves amid the bushes and grass. Sometimes you will observe several young adhering to the abdomen of the mother. These she assists in keeping their hold by pressing her tail against them as she climbs down the stems of the briers. The female produces young two or three times during the spring and summer, having from three to six young at a birth.

It has a habit of laying up little stores of grain and grass seeds. In our State they are generally composed of wheat, but in the South, of rice. It is also fond of corn, but eating the heart only and leaving the rest untouched. This species is sometimes accused of destroying cabbage plants and other young and tender vegetables, and of gnawing the bark from young fruit trees. It is doubtless that this species is sometimes to blame, but the greater amount of this damage, I think, is caused by the meadow mouse (*Arvicola riparius*, Ord), and the so-called "pine mouse" (*Arvicola pinetorum*, Le Conte.

The white-footed mouse is of crepuscular and nocturnal habits. Many of them fall prey to the different species of owls, notably the screech owl (*Scops asio*, Linn.), as the bones and fur of this mouse found in their ejected pellets clearly show. It has a wide geographical range, being found from Nova Scotia to Florida, and west to the Mississippi River, and perhaps far beyond. C. FEW SEISS.

THE PHOTOGRAPHING OF MOTION.

The admirable method devised by Mr. Muybridge, and which consists in employing instantaneous photography for analyzing the motions of man or animals, still left to the physiologist a difficult task; for it became necessary to compare with each other successive images, each of which represented a different attitude, and to class such images in series according to the position in time and space that corresponded to each of them.

Let us admit that nothing has been neglected in the experiment; that, on the one hand, the points of reference that photography is to reproduce have been arranged along the track to be passed over by the animal, so as to permit of ascertaining at each instant the position that he occupies in space; and that, on another hand, the instant at which each image has been taken is determined, as happens with photographs taken at equal intervals. All such precautions having been taken, it is still necessary, in order to obtain from the figures the meaning hidden therein, to superpose them one over the other (either in imagination or actually), so as to cover a paper band, corresponding to the road traversed, with a series of overlapping images, each of which expresses the position that the body and limbs occupied in space at each of the moments considered.

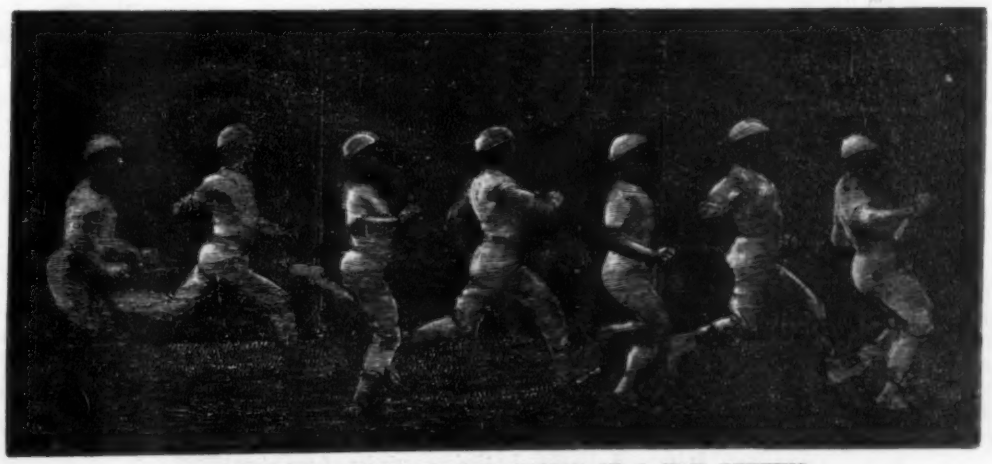
Such representations give rise to figures like those that the Weber brothers have introduced into use for explaining theoretically how man walks. In the works of these gentlemen we see only a series of silhouettes of men, shaded with cross-hatching of decreasing strength, and overlapping so as to represent the successive displacements of the legs, arms, trunk, and head at the different phases of one step. This mode of representation is the most striking one that has as yet been devised, and it has been adopted in the majority of classical treatises. Now, it has appeared to me (and experience has confirmed the prevision) that we might demand figures of this kind from photography; that is to say, unite on the same plate a series of successive images representing the different positions that a living being moving at any gait whatever has occupied in space at a known series of instants.

Let us suppose, in fact, that a photographic apparatus be set up on the road which is being traversed by a walker, and that we take the first image in a very short space of time. If the plate were to preserve its sensitiveness, we might, in an instant, take another image that would show the walker in another attitude in another point of space. This latter image, compared with the former, would exactly

THE WHITE-FOOTED MOUSE, OR DEER MOUSE.

indicate all the displacements that had occurred at the second instant. By multiplying the images in this way at very short intervals, we should obtain a succession of the phases of locomotion with perfect authenticity.

Now, in order to keep the photographic plate as sensitive as necessary for successive impressions, it is necessary that absolute darkness shall exist in front of the apparatus, and that the man or animal that is passing shall be detached in white from a black background. But the blackest objects, when they are strongly lighted, still reflect many actinic rays; and so I have had recourse, in order to obtain an absolutely black field, to the method pointed out by Chevreul, my screen being a cavity with black sides. While a man wholly clothed in white, and brightly lighted by the sun, is walking, running, or jumping, the photographic apparatus, which is provided with a more or less rapidly revolving shutter, takes his image at more or less approximate intervals. This same method may be applied to the study of different types of locomotion; and a white horse, or a white bird, will give in the same way a series of their attitudes.



THE SUCCESSIVE PHASES IN THE MOTION OF A MAN RUNNING.

The window in the disk of my shutter may, at will, be enlarged or reduced, so as to regulate the duration of pose according to the intensity of the light, or according to the velocity with which the disk revolves. With the window reduced, and a slow rotation, we obtain images widely spaced apart. A rapid rotation gives more approximate images, but one whose time of pose might be insufficient if the window were not enlarged. Finally, a swinging shutter placed before the other serves for regulating the beginning and end of the experiment.

The proofs from the negatives that I have obtained, and a sample of which is shown in the engraving, were made at the physiological station of the Parc des Princes, where I worked with the aid of Mr. G. Demeny.—*E. J. Marey, in La Nature.*

Strontia in Sugar Refining.

Dr. Bittmann delivered an address at Magdeburg, in which he gave the following description of the use of strontia for the recovery of sugar from molasses.

As early as 1849, Dubrunfaut and Leplay received a French patent on a strontian process, but it does not seem ever to have been put into practice. At all events, it was totally unknown to Max Fleischer, who was experimenting on it ten years ago, and who perfected his process to such an extent that he offered it to a sugar manufacturer, Hermann Kuecken. This was the origin of the Dessau Sugar Refining Stock Company, which has been using the process for ten years, and, after overcoming many difficulties, they have, within the last four or five years, brought it to such a state of technical perfection that it has outstripped every other process for removing sugar from molasses. At first, the chief difficulty lay in securing enough of the material. Recently, the Dessauer factory has obtained the greater part of its supply from the large mines of strontianite in Westphalia, and besides that a large chemical factory has been erected at Rosslau, for working celestine, which can be had in inexhaustible quantity in Sicily, so that hereafter there will be no difficulty in getting material, and the principal objection to the process is removed.

The operation is conducted as follows: Caustic strontia in substance, or in solution, is added to the heated molasses, and at boiling heat the sucrate of strontium separates from a tolerably concentrated solution in the form of an insoluble bisaccharate which is almost completely insoluble. In order to precipitate as nearly as possible all of the sugar, enough strontium must be added to leave a ten per cent solution of caustic strontia, in which is suspended the sugar compound of strontium; this is very easily accomplished. The separation of the precipitate from the mother-liquor takes place in an apparatus where a vacuum can be obtained for sucking the liquid out of the saccharate. The latter is in the form of a plastic, granular paste, the consistence of which makes it easier to remove the mother-liquor. After draining, it is washed repeatedly with a concentrated solution of caustic strontia, and the latter is then sucked out. In this manner a saccharate of extraordinary purity is obtained. The loss of sugar, when these conditions are closely observed, is inconsiderable. On the average the water that runs off contains 1¼ per cent of sugar.

The saccharate could be decomposed directly with carbonic acid, and carbonate of strontia would be formed, which could be used again, while the solution would contain sugar, and would only need to be filtered through bone black and then refined. But the saccharate possesses one remarkable property, that it decomposes spontaneously. It splits up in such a manner that, from a saccharate containing two molecules of strontium and one of sugar, at least one molecule of caustic strontia crystallizes out, while all the sugar remains in the solution, which also holds a portion of the strontia in solution. This property of the saccharate is of considerable practical interest, since it is not necessary to use carbonic acid for precipitating all the strontia that is used, and consequently not more than half of the material has to be put through the tiresome process of regeneration. If the decomposition is performed in an intelligent manner, it can be made to yield considerably more than one molecule of strontium hydrate by spontaneous separation. For this purpose the saccharate is mixed with water and then left to itself: crystals of caustic strontia are formed, which can be utilized at once for a fresh operation, and a solution of sugar, from which the strontia is precipitated by carbonic acid. The solution is then passed over bone-coal, and from this moment it is refinery sirup, which can be used immediately in the refinery, and at Dessau it is evaporated and converted at once into cube sugar by Langen's process. Or the crystalline mass can be put in Fesca's centrifugal, and a fine marketable product obtained.

The regeneration of the strontium requires a good deal of room, and owing to its difficulty it is by far the largest half of the process. For a long time Dessau has been fighting the problem of finding out the right way to convert the precipitated carbonate of strontium into caustic strontia, and in the course of the past year has arrived at a complete system of doing so. The slimy mass of carbonate left in the filter presses is mixed with saw dust and pressed in bricks, which are burned in a gas furnace. The ignited mass consists of anhydrous oxide of strontium, or strontia.

The mass is leached out, and put in crystallizing vessels to crystallize. The lye, which is made on a large scale, contains while hot about thirty per cent of hydrate of stron-

tium, of which some twenty-eight per cent is precipitated by cooling. The crystals are used in the factory for treating a fresh quantity of molasses. Strontianite is converted into the caustic form by fusing in a manner similar to working over the artificial carbonate.

Since manufacturers lay great stress on the fact that, as salts are taken away from the soil, we must call attention to the fact that the strontian process yields a mother-liquor free from sugar which is entirely equal to that made by other methods, both qualitatively and quantitatively, and that it is perfectly adapted to all the purposes to which the liquors from other processes are employed. They are used at Dessau, Waghäusel, and Zytyn, for making potash; and the attempt has also been made to obtain methyl icohol, methylamine, and ammonia from them by dry distillation.

The following remarks are made regarding the difficulties of the process. The chief difficulty, as already mentioned, was to get a supply of strontianite; this has been entirely overcome by the discovery of new mines and the substitution of celestine. The ignition offers another difficulty, for in burning under various circumstances, every possible kind of slag is formed, causing a greater or less loss of the costly material —strontium; it can be said that this difficulty was overcome a few years ago, and that the consumption of strontium is not a large one. At each of the stations a definite stock of strontium is in use, and beside this there is a loss of six or eight tons to every hundred tons of molasses worked up.

Dr. Bittmann was not able to answer the question as to what percentage of sugar the molasses would yield by this process. Dr. Reichardt said that, although a very difficult one to answer, yet he believed that as much as thirty-eight per cent of sugar might be obtained from the molasses.—*Deutsche Industrie Zeitung.*

DECISIONS RELATING TO PATENTS, TRADE MARKS, ETC.

United States Circuit Court—Southern District of New York.

BRAINARD *vs.* CRAMME.—PATENT SHAVINGS WASHER.

Wallace, J.:

The original patent bears date January 5, 1869, and is for an improved machine for washing shavings in breweries.

The reissued letters bear date February 26, 1878, and herein the patentee attempts to secure to himself both a process and the apparatus for carrying out the process for washing shavings in breweries.

So far as the reissue is an attempt to secure to the patentee the process for the treatment of brewers' shavings it is entirely inoperative. The process, as described and claimed therein, is merely for the treatment of the shavings by the employment of the described apparatus. It is difficult to appreciate any practical benefit which is obtained by the patentee by calling his patent a process patent, instead of one for the machine; and it is conceded that as everything essential to the process was pointed out in the original patent nine years before the reissue, and in the meantime other inventors have occupied the ground covered by the general subject matter of the invention, what was therein pointed out and not claimed is to be deemed abandoned to the public within the recent decisions relative to reissues. As to the claims for the process, the complainant proposes to file a disclaimer.

When a process claimed in a reissue granted nine years after the original is merely the employment of the devices described in such original, and is therefore fully disclosed, and other inventors have in the meantime occupied the ground, such process must be held to be abandoned to the public.

Claims in a reissue are to be construed, if the language will reasonably bear such an interpretation, so as not to embrace any invention broader in its scope than that in the original.

Reissue No. 8,099, to Edwin D. Brainard, for washing shavings in breweries, dated February 26, 1878, sustained.

United States Circuit Court.—District of Maine.

NO. 166—JONES *vs.* BARKER *et al.* NO. 170—BARKER *et al. vs.* JONES. NO. 246—BARKER *et al. vs.* JONES.—PATENT GREEN CORN CUTTERS.

Lowell, J.:

Winslow's patent, No. 51,379, and Jones's patent, No. 54,170, for green corn knives, declared invalid.

A suit begun upon one patent cannot be sustained upon a reissue of that patent; hence a suspension of proceedings cannot be had for the purpose of obtaining such reissue.

Reissue of letters patent, No. 55,614, dated June 19, 1866, upon enlarged claims, thirteen years after the grant of the orignal, declared invalid.

Claims are to be construed by the state of the art, even though the patent contains no acknowledgment of it.

These three cases, argued together, relate to patents for cutting green corn from the cob for the purpose of packing it in cans. Isaac Winslow, the uncle and predecessor of J. W. Jones, appears to have invented or introduced this industry, which has become of much importance. It was found that his process was substantially that by which other vegetable substances had been preserved, and so he lost his patent for the process. In describing his process he described a curved knife with a gauge as a convenient instrument for cutting the corn from the cob, and about twelve years afterward he obtained the patent, No. 51,379, now owned by Jones, who himself patented an improvement in the gauge, No. 54,170, also sued upon. One Lewis obtained a patent for a machine to cut corn, No. 94,013, which has been assigned to Jones. These are the three patents relied on in suit No. 166.

The Circuit Court, sitting in Maryland, decided that the knife patents were void for want of novelty. (*Jones vs. McMurray*, 2 Hughes, 527.)

There can be no doubt that the Winslow knife was in public use for years before 1865.

The Jones patent was held, in the case first above cited, to be anticipated by the Oot paring knife, patented in 1858, No. 21,695, and I see no reason to doubt the soundness of the decision. At all events it reduces the patent to so narrow a claim that it cannot be infringed by the knives of the Barker machine.

The Lewis machine is admitted to be very crudely and imperfectly described in his specification, so much so that application was made to me to suspend this case until a reissue could be obtained. This I refused, for the reason, among others, that a suit begun upon one patent could not be sustained upon a reissue of that patent. Upon a preponderance of the evidence I am strongly inclined to think that a mechanic skilled in the art of making similar machinery could not make one of Lewis' machines.

No. 246 rests upon the patent of Burt and Dunn, dated June 19, 1866, No. 55,614, which appears to have been bought in the course of this litigation, and then to have been reissued.

The defendants do not infringe either of the original claims.

In the reissue the two claims are expanded into eight, intended and calculated to cover all combinations of cutters and scrapers in a machine of this sort. The excuse for this enlargement of the claims is that Burt and Dunn were the first persons who made a machine which effected the purpose of cutting and scraping an ear of green corn at one operation. Under former decisions of all the courts this argument might, perhaps, be accepted, though the expansion is very considerable; but the Supreme Court have lately restored the law to what they find to have been the true meaning of the act of Congress authorizing reissues. (*Miller vs. Bridgeport Brass Company*, 21 O. G., 201.) In summing up the conclusions of the court in that case Mr. Justice Bradley says, page 203:

"Now, while, as before stated, we do not deny that a claim may be enlarged in a reissued patent, we are of opinion that this can only be done when an actual mistake has occurred, not from a mere error of judgment, for that may be rectified by appeal, but a real *bona fide* mistake, inadvertently committed, such as a court of chancery in cases within its ordinary jurisdiction would correct."

He goes on to show the danger and injustice to others of such enlargements, and says that they must be applied for at once, before new inventions have been made. He intimates that two years, in analogy to the law of forfeiture, would be the utmost possible limit of time, but, as I understand the opinion, that anything like two years would be inadmissible in ordinary cases.

This reissue was obtained thirteen years after the patent was granted, and is open to all the objections pointed out in the general reasoning of the opinion, though the case itself is not exactly like the principal one.

This bill must be dismissed.

No. 170.—This case is brought upon the patent issued in 1875, No. 159,741. The machine of Barker has been found much more useful than any which preceded it.

No. 170, decree for complainant.

No. 166, bill dismissed.

No. 246, bill dismissed.

United States Circuit Court.—Southern District of New York.

GINTER *vs.* KINNEY TOBACCO COMPANY *et al.*—TRADE MARK.

Wallace, J.:

So far as appears upon this motion the term "straight-cut," as applied to cigarettes, is a term descriptive of the ingredients and characteristics of the article, and therefore the complainant cannot appropriate it as a trade mark and enjoin the defendants from advertising their article as "straight-cut cigarettes."

In the preparation of smoking tobacco several different processes of cutting the leaf are employed, and the product is designated by the term which describes the particular process which it has undergone, such as "straight-cut," "curly-cut," "long-cut," and "fine-cut." "Straight-cut" designates that particular product in which the plant has been so cut and treated at the time of cutting as to preserve the fibers long, even, straight, and parallel when prepared for sale or use. It is stated also that the choicer varieties of the plant are usually selected for this mode of treatment, and the product is especially desirable for cigarettes. In view of these facts it is evident that when the term is applied to cigarettes it implies that they are made of straight-cut tobacco.

In a circular of May 1, 1881, he states that his "straight-cut tobaccos are cut from the choicest varieties of Virginia gold and sun-cured leaf, and are cut to be straight in the boxes, and are very desirable for making cigarettes." He now insists that the term was selected and has been employed by his business predecessors and himself as an arbitrary designation of his particular article, and that neither his cigarettes nor the defendants' are made of straight-cut tobacco. All this, if true, does not help the complainant's case, but, to the contrary, furnishes an additional reason why he should be denied the assistance of a court of equity.

It appearing that the term "straight-cut" has a well-defined meaning in the trade as indicating a product prepared in a certain manner, and that as applied to cigarettes it fairly carries the implication that they are made of straight-cut tobacco, *Held*, that the term is descriptive of the ingredients and characteristics of the article and cannot be appropriated as a trade mark.

Nor can it be appropriated as an arbitrary designation by a dealer whose cigarettes are not made of straight-cut tobacco, since he merely misuses the term in a manner calculated to deceive the public.

No principles are better settled in the law of trade marks than that a generic term, or a name merely descriptive of the ingredients, quality, or characteristics of an article of trade, cannot be the subject of a trade mark, and that the use of a name or term which is likely to deceive the public in reference to the components or nature of the article to which it is applied will not be tolerated.

Herbert Spencer.

The distinguished English philosopher, Herbert Spencer, was a passenger on the steamer Servia, which arrived at this port Aug. 21. Mr. Spencer's sole object in making this visit is for the benefit of his health, which has long been feeble and latterly has been the occasion of much anxiety to his friends. The limit set for his stay is three months, unless he should derive marked benefit from the change of climate, which will be sincerely hoped by hosts of admirers.

Mr. Spencer is now sixty-three years of age. He was born at Derby, England, the son of a tutor in humble circumstances, but celebrated as a mathematician. He early showed great promise in mathematics, the related sciences, and a taste for the study of insects.

At seventeen he entered the service of the London and Birmingham Railway Company as engineer, but resigned the place at the end of two years to devote himself to study. About this time he gave evidence of ability as an inventor; and had his lot been cast in this country, where invention was encouraged as it was not in England, his fame might now have rested on a material rather than a metaphysical basis.

He proposed improvements in the manufacture of watches, since generally adopted; a new form of printing press; a machine for type making, and the glyptographic process of engraving. In 1843 he sought literary employment in London, but failed to get it. He had already begun to discuss philosophically "the proper sphere of government" in the *Nonconformist*, but his opinions did not take with the reading public. He was by instinct an evolutionist, and the doctrine of evolution had yet to fight its way to tolerance.

Now, thanks largely to Mr. Spencer's writings, the then despised doctrine has become the dominant one in modern philosophical thinking. Among Mr. Spencer's important works are: "Social Statics" (1850), "Principles of Psychology" and "Railway Morals and Railway Policy" (1855), "Essays" (1857), "Education: Intellectual, Moral, and Physical" (1860); "First Principles of a System of Philosophy" (1862), "Classification of the Sciences" and "Principles of Biology" (1864), "Spontaneous Generation" (1870), "The Study of Sociology" (1873), "Descriptive Sociology" (1874), and "Ceremonial Institutions" (1878). He also began, in 1874, "The Principles of Sociology," of which five parts have appeared, the last, "Political Institutions," within a few months.

Although Mr. Spencer's avowed purpose is to spend the coming three months quietly and without literary effort, we may reasonably expect that his observations will not be lost to social science. He will visit Canada and the principal cities of the United States.

Priming for Oil Paint.

O. Kall, of Heidelberg, prepares a substitute for boiled oil by mixing ten parts of whipped blood just as it is furnished from the slaughter-houses with one part of air-slaked lime sifted into it through a fine sieve. The two are well mixed and left standing for twenty-four hours. The dirty portion that collects on top is taken off, and the solid portion is broken loose from the lime at the bottom, the latter is stirred up with water, left to settle, and the water poured off after the lime has settled. The clear liquid is well mixed up with the solid substance before mentioned. This mass is left standing for ten or twelve days, after which a solution of permanganate of potash is added which decolorizes it and prevents putrefaction. Finally the mixture is stirred up, diluted, if necessary, with more water to give it the consistence of very thin size, then filtered, a few drops of oil of lavender added, and the preparation preserved in closed vessels. It is said to keep a long time without change. A single coat of this liquid will suffice to prepare wood or paper, as well as lime or hard plaster walls, for painting with oil colors. This substance is cheaper than linseed oil, and closes the pores of the surface so perfectly that it takes much less paint to cover it than when primed with oil.—*D. I. Zeit.*

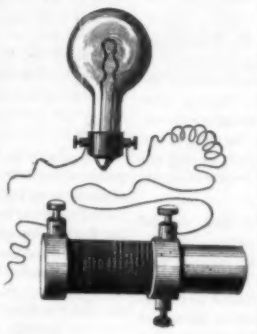
Mining Engineers in Denver.

The eleventh annual meeting of the American Institute of Mining Engineers was held in Denver, Colorado, closing a ten days' session August 29. About a hundred members were present, and much time was spent in visiting the Mining Exhibition and the mineral regions of the State.

RECENT INVENTIONS.

Rheostat for Electric Lamps.

Among recent inventions we find a rheostat that consists of a spiral coil connected in an electric circuit and fitted with an adjusting device, by which a greater or less number of the wires of the coil may be brought into contact, thus varying the resistance. In the annexed engraving A is a coil formed of fine wire, preferably German silver. A support is provided, consisting of a short rod of non-conducting material having a fixed and a loose collar; upon this rod the fine wire is wound in a loose spiral, and it has its ends connected to the fixed and loose collars. The loose collar is fitted with a set screw for securing it in any position in the length of the rod. By moving the loose collar out on the rod the coil is stretched and opened, or by a reverse movement the coil is closed, so that there is contact between the coils. The circuit wires connect to the ends of the coil at the fixed and sliding collars. The resistance offered by the coil depends upon the length of the coiled portion opened by adjustment of the slide. The closed portion is short circuited, and allows the current to pass freely. This regulator may be used for electric currents generally, and is specially adapted for electric lamps. It is the invention of Mr. Patrick H. Fox, of New York city.



Bridle Bit.

A novelty in the construction of bridle bits, by which the attachment of the cheek strap, curb strap, check strap, and reins to bits, and their detachment therefrom, are greatly facilitated, has been patented by Mr. Ellis Little, of New York city. The mouth-piece is made in two parts, fitted to each other and connected by screws; and in the adjacent sides of the ends of these parts are formed half-round notches to serve as bearings for the journals of the side bars. The journals of the side bars are made longer than the thickness of the ends of the mouth-piece, so that the piece may have a slight up and down movement upon the bars. Upon the upper end of the side bar is formed an open ring, the ends of which are overlapped and beveled on their adjacent sides, and are such a distance apart that an ordinary strap can be slipped between the overlapped ends upon the side bar. At the upper side of the end of the mouth-piece is formed a curved hook, the free end of which is beneath the mouth-piece and is bent upward so as to be parallel with the side bar.

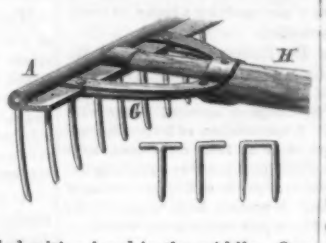
Upon the rear side of each end of the mouth-piece is formed a projection to cover the end of the curved hook, so that a strap cannot come out when the bit is in use. With this construction, by turning the side bar, so as to bring the curved hook into line with the mouth-piece, and slipping the mouth-piece upward, the rein can be readily slipped over the hook and attached or detached, and all the straps may be attached and detached without loosening a buckle.

Road Scraper.

A road scraper that is admirably adapted for its intended purpose has been patented by Messrs. George Gregory and George Austin, of Skaneateles, N.Y. The body of the scraper is made of a plate of boiler iron, and to its lower edge is secured a cutting blade of steel. The tongue is hinged by a hook to a loop in the center of the scraper, and brace rods hinged in the same manner to near the ends of the scraper have at their outer ends hooks that engage with eyes placed on the side of the tongue, P. By this means the tongue can be turned toward either end of scraper, and held by the rods to give the scraper a slanting position in relation to the tongue. The body of the scraper is held and adjusted vertically by a rod hinged to the top of the handle, and passing down to a pin placed in one of a series of holes in the tongue. The scraper is simple in construction, strong, and durable, and is especially adapted to scraping roads and turnpikes. It is easily taken apart without any tools, and needs but little room for storage.

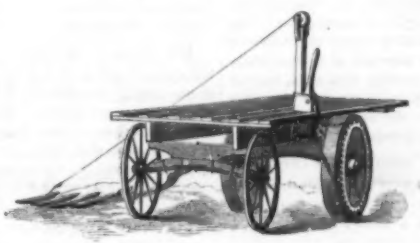
A Novel Rake.

Mr. Olof Bergstrom, of Finshyttan, Sweden, has patented an improved rake for raking hay, earth, etc. A metal plate, A, is provided with a series of apertures through which the teeth are passed, as shown in the engraving. The teeth may be made U, L, or T shaped, the transverse pieces resting on the plate. After the teeth have been inserted in holes in this plate, the outer longitudinal edge of the head plate, A, is turned over the transverse pieces of the teeth, forming a hollow head at the outside of the plate, by which the teeth are held in place and the plate strengthened. The handle socket is formed of two U-shaped braces, G, provided with a bend in the middle. One of these bands is placed on the upper and the other on the under side of the head plate, and riveted, the rivets passing through a metal band bent to form a semicircular socket on the plate for receiving the end of the handle. The U-shaped braces are also riveted on each side of the bends, forming the handle loop, H.



New Hay Loader.

A machine for raising hay from the ground and carrying it to the rack of a wagon to be loaded, has been patented by Mr. Geo. Meader, of Fowler, Ind. A frame is secured on the bolsters of the wagon, and a cross beam secured to the under side of the frame projects a short distance from it, between the front and hind wheels. A rake is pivoted to the end of the beam by curved bars, that allow it to run level with the ground, to be drawn under the bunches of hay. A rope attached to the outer end of the rake passes over a guide pulley in the top of a standard on the side of the wagon opposite the rake, and down to a winding drum that is put in gear by means of a clutch and lever with a shaft drive by a chain belt from one of the wagon wheels. When the rake has gathered its load, the lever is moved and the winding drum put in gear, and the rake with its load is raised to the wagon. When the clutch lever is shifted to disengage the drum, it binds the winding rope against the standard and acts as a brake to regulate the descent of the rake.



Tiles.

Tiles are thin slabs of baked clay, of whose manufacture we gave a description in these columns some time ago. They are extensively used in Europe for various purposes—roofs, gutters, pavements, drains, house siding, lining flues, furnaces, etc. They assume many forms; some have a local character, others are made in imitation of the antique.

Plain tiles are usually made five-eighths of an inch in thickness, 10½ inches long, and 6¼ inches wide. They weigh from 2 to 2½ pounds each, and expose about one-half to the weather. Seven hundred and forty tiles cover 100 superficial feet. They are hung upon the lath by two oak pins inserted into holes made by the moulder. Plain tiles are now made with grooves and fillets on the edges, so that they are laid without overlapping very far, the grooves leading the water. This is economical of tiles, and saves half of the weight, but is subject to leak in drifting rains, and to injury by hard frosts.

Pan tiles, first used in Flanders, have a wavy surface, lapping under and being overlapped by the adjacent tiles of the same rank. They are made 14½ x 10½; expose 10 inches to the weather; weigh from 5 to 5¼ pounds each; 170 cover 100 square feet of surface.

Crown, ridge, hip, and valley tiles are semi-cylindrical, or segments of cylinders, used for the purposes indicated. A gutter tile has been introduced in England, forming the lower course, being nailed to the lower sheathing board or lath.

Siding tiles are used as a substitute for weather-boarding. Holes are made in them when moulding, and they are secured to the lath by flat-headed nails. The gauge, or exposed face, is sometimes indented to represent courses of brick. Fine mortar is introduced between them when they rest upon each other. Siding tiles are sometimes called weather tiles and mathematical tiles; these names are derived from their exposure or markings. They are variously formed, having curved or crenated edges, and various ornaments, either raised or encaustic.

The glazed tiles are inferior to slate, as they imbibe about one-seventh of their weight of water, and tend to rot the lath on which they are laid. Good roofing slate only imbibes one two-hundredth part of its weight, and is nearly waterproof.

Encaustic tiles are ornamental tiles, having several colors. A mould is prepared which has a raised device on its face, so as to leave an impression on the face of the tile cast therein. This intaglio recess is then filled by a trowel with clay compounds, in the liquid or slip stage, and which retain or acquire the required colors in baking. The tile is then scraped, smoothed, baked, and glazed. This tile is common in ancient and modern structures. The glazing came from the Arabs, who derived it from India, and primarily from China.

Drain tiles are either moulded flat and bent around a former to the proper shape, or are made at once of a curved form by pressing the clay through a dod or mould of the required form. The latter plan is now generally used.

Various machines are used in the manufacture of tiles. One of these has two iron cylinders, around which webs of cloth revolve, whereby the clay is pressed into a slab of proper thickness without adhering to the cylinders. It is then carried between two vertical rollers, which impart a semi-cylindrical or other required shape, after which the tiles are polished and finished by passing through three iron moulds of horseshoe form, being at the same time moistened by the dripping of water from a tank above, and finally conducted off upon an endless web.

In more recent machines the tiles are generally formed at one operation, by pressing. A charge of clay sufficient to form a number of tiles is placed in a cylinder and subjected to the action of a piston, which forces it out as a continuous tube, after which it is cut in lengths by a wire. The most modern machines generally employ a screw, which serves at the same time to mix the clay and force it through the mould; the process of feeding and moulding is thus rendered continuous, no time being lost in charging the cylinder.

One of the most improved of modern machines consists of a vertical pug mill, containing rotary curved knives and a screw follower for forcing the clay through the dies. The pipe, on issuing from the dies, is carried forward by a series of rollers having hollowed surfaces, and is cut into lengths by a rocking frame provided with cross wires. In another machine the clay is forced through the ties by two plungers working in boxes at the base of the pug mill, and reciprocated by cranks set at right angles to each other on the same shaft; two sets of dies are employed; one plunger being retracted to allow its box to receive a supply of clay, while the other is engaged in forcing the clay through its die.

Tiles are usually placed in the kilns in bunches of twelve, and laid alternately cross and length wise. The spacing of the tiles allows the circulation of the heat between them, and the circular form of oven is found well adapted to secure uniformity of heat. The kiln is protected on the windward side to prevent uneven urging of the fires. The oven being set, the doorway is bricked up and daubed, the fires kindled and kept burning, moderately at first, and then more freely. The usual time for firing is thirty-eight hours. Three days are then allowed for cooling, and they are afterward taken out of the kiln. Those tiles that are to be made of a grayish color are thus treated: It having been ascertained that the tiles are burnt enough, and while still red-hot, a quantity of small fagots of green alder with the leaves on is introduced into each flue. The flue holes are then well secured, and the holes in the roof each stopped with a paving tile, and the whole surface is covered with four or five inches of sand, on which a quantity of water is thrown, to prevent the smoke from escaping anywhere. It is this smoke which gives the gray color to the tiles, both internally and externally. The kiln is then left closed for a week, when the sand is taken off the top, the door and roof holes are opened, as also the flue holes, and the charcoal produced by the fagots taken out. Forty-eight hours after the kiln is cool enough to allow the tiles being taken out and the kiln charged again. Whenever any of the tiles are to be glazed they are varnished after they are baked; the glaze being put on, the tiles are put in a potter's oven till the composition begins to run. The glaze is generally made from what are called lead ashes, being melted and stirred with a ladle till it is reduced to ashes or dross, which is then sifted and the refuse ground on a stone and resifted. This is mixed with pounded calcined flints. A glaze of manganese is also sometimes employed, which gives a smoke-brown color. Iron filings produce black; copper slag, green; smalts, blue. The tile being wetted, the composition is laid on with a sieve, and the tile subjected to the heat necessary to vitrify the application.—*Pottery and Glassware Reporter.*

Malarial Germs.

The cause of malarial diseases is said to have been discovered by Prof. Laveran, a French physician of Val-de-Grace. It is a very minute organism, named by him *Oscillaria malaria*. M. Richard, who announced the discovery in the French Academy of Science, has found these microbes in all the fever patients of the Philippeville hospital in Algeria. These are located in the red blood-corpuscles, and completely destroy their contents. They can easily be rendered visible by treatment with acetic acid, but otherwise it is difficult to detect them in the corpuscles. They look like a necklace of black beads, with one or more projections, which penetrate the cell of the corpuscle, and oscillate or move like whips.

ENGINEERING INVENTIONS.

A new device for adjusting the packing of a piston, so that it will fit very closely in the cylinder, has been patented by Mr. James Preston, of New York city. The piston is formed of a valve cage attached to the end of a rod, the lower edge of the cage being provided with an external beveled flange, and of a beveled ring, attached to the ends of a *fork*, secured to the lower end of the tube surrounding the rod of the valve cage. Between the beveled ring and the beveled flange on valve cage a packing is held, which is wound spirally around the valve cage. The rod of valve cage and the tube are adjusted to press the packing more or less, by means of nuts and threads at their upper ends.

Mr. Edward B. Meatyard, of Geneva, Wis., has patented an improved hoisting apparatus of the class in which one bucket or car counterbalances another. Three or more friction pulleys of proper diameter for one or more ropes are provided with deep spur cog rims, of larger diameter and less face than the pulley. A rubber ring, that forms a cushion for the rope, is fastened between the cog rim and an annular plate, fastened on the side of the pulley. With this construction the rope is saved from the wear that it usually has when a drum is used.

A power wheel, to be operated by the current of a stream, has been patented by Mr. Walter M. Coffman, of Elizabethtown, Tenn. A circular track divided into two nearly equal horizontal sections, one placed above the other and connected by inclines, is placed on the top of a suitable frame in the current of a stream. At the center of the track a vertical shaft is journaled in the frame, and to the shaft radial arms are hinged, having caster wheels on their under sides that move on the circular track, and also have buckets at their outer ends. As the arms rest down on the track, those on one side are in the water and carried by the current, while the arms on the opposite side are raised out of the water.

Mr. Maxcy R. Hall, of Fairmount, Ga., has patented improvements in steam pumps, in which the main pistons and the valve mechanisms are made interdependent upon each other, so that one cannot work without the other. The piston of the main steam and water cylinders are in line with each other and are attached to the same rod. On each of these cylinders are small auxiliary steam and water cylinders, also in line, and their pistons connected by the same rod by means of tappets properly placed. The movement of the main steam piston operates the piston of auxiliary chamber, also operating the valves of auxiliary water chamber to control the inlet and outlet of the water.

An improved car coupling has been patented by Mr. William C. Donaldson, of Atchison county, Kan. It consists in a link attached to a rack bar placed in a groove in the drawhead of the car, the link being drawn back into the drawhead and thrust out again by means of a pinion that engages with the rack bar and is operated by a shaft and crank that projects from the side of the car. A similar device is used for raising and dropping the coupling pin.

Mr. George W. Dudley, of Waynesborough, Va., has patented an improvement in the rotary engines described in patent No. 236,907. In that engine the seat of the exhaust valve was arranged to oscillate for the purpose of reversing the engine, but in the improved engine, the seat is made stationary, and is provided with a plug valve by means of which the exhaust may escape at either end of the exhaust valve, and an improved means for shifting the valve in reversing the engine have also been provided.

Mr. William E. Harris, of New York city, has patented improvements in ore grinding and amalgamating machines. The ore is fed into a hopper and passes into the space between horizontal grinding plates and is crushed. As it is crushed it is fed outward by centrifugal force, and escapes at the outer edges of the plates into a circular trough, where it is further pulverized between ring grinding plates and the sides of the trough. In amalgamating ore the ground pulp is fed into the hopper, with sufficient water to carry off the tailings, and a quantity of quicksilver is placed in the circular trough, and the mill revolved at a slow rate of speed.

An improved automatic car coupler has been patented by Messrs. Elmer A. Converse and Nathaniel T. Griffin, of Monticello, O. The drawheads of the cars are of the usual construction, except that a longitudinal oblong mortise is provided instead of the round hole for coupling pin. Instead of using round pins, broad flat plates are set edgeways to the coupling links, the lower ends of the plates being closed on the front side so that when the end of the link strikes the pin the pin will be forced up, and when the end of the link has passed will fall back and thus couple the cars.

MECHANICAL INVENTIONS.

Mr. Austin Leyden, of Atlanta, Ga., has patented an improved cotton baling press, in which the follower of the press is operated with great force by means of a system of levers that receive their motion from racks worked by a ratchet lever, the lever being worked by an eccentric and toggle device driven by a quick running shaft. As the resistance increases in the press, the leverage of the system of levers increases, giving greater power for the greater resistance.

An improved feed roller for wood planers has been patented by Mr. Emmett R. Henderson, of Sanford, Fla. The feed roller consists of sectional rollers mounted on a shaft in such a manner that the sections may have a vertical motion on the shaft to rise and fall, according to the different thicknesses of the lumber to be planed. Independent pressure rollers are provided for each section, having springs by which the pressure is applied. Chain belts are used for driving the feed rollers so that the motion shall be positive. With this construction boards of different widths may be planed at the same time, and also tongued and grooved if desired.

An ingenious invention relating to wind motors has been patented by Mr John McLachlin, of New Orleans, La. The wind wheel is provided with a turret that is secured at its base upon rollers and has an opening on one side, and within the turret are curved plates that serve as deflectors to direct the wind current down upon the wind wheel. A vane secured to the turret keeps the opening in the turret always toward the wind. The wind wheel is of suitable construction to be operated by the wind currents deflected from the turret.

A vertical windlass, designed for unloading hay or straw from wagons into barns, etc., has been patented by Messrs. S. J. Miller and T. R. Ballard, of Millersville, Ill. The windlass is designed to be operated by horse power, and the winding drum, which is placed at the upper end of a vertical post, is loose to rotate on the post. The drum has combined with it mechanism for engaging it with the post, so as to rotate when draught is applied to a sweep secured to the post, disengaging it and applying a brake to check its free running if necessary.

Messrs. James D. Bratton and Henry H. Good, of Westmoreland, Kan., have patented improvements in the class of wagon brakes that are applied to the front wheels of vehicles, and operated by the team when holding back. A combination of levers, that are provided with brake shoes at their outer ends, have their inner ends connected by a pressure-equalizing device to a rod, secured to a sleeve sliding on the outer end of the tongue, and is pressed back to operate the brake by the neck yoke or pole straps of the wagon.

Improvements in springs and running gear for side bar vehicles have been patented by Mr. Andrew F. Shuler, of Arcanum, O. Each of the springs consists of a flat spring, one end of which is secured to one of the side bars near its end, is then curved downwardly, thence upwardly, to the bottom of the buggy body to which it is secured. From this point it is again curved downwardly and upwardly, its outer end resting on the bottom of the buggy near its outer side, thus providing a long and easy spring.

Mr. Samuel D. Webb, of Washington, D. C., has patented an improved locking-up device for type forms. Four quoins are used to lock up the form, each being provided with bearing surfaces of different lengths, and adapted to be reversed on a screw by which they are connected, so that a longer or shorter surface shall be presented to the form, as the case may require. The screw has a right and left hand thread, and when it is turned the blocks of the quoins are moved to or from each other.

Mr. Charles J. Gibson, of Bergen Point, N. J., has patented a rotary clutch consisting of two clutch sections, one of which has two sets of ratchet teeth, projecting toward each other, one inwardly and one outwardly, and both lying in the same plane. The other clutch section has a sliding catch that vibrates in a radial line between the two sets of ratchet teeth, when the driving section is moving backward, but engages with a positive movement either one or the other of the sets of ratchet teeth on the driven section when the driving section is moved forward.

An improvement in pumps has been patented by Messrs. Andro Enborn and John A. Anderson, of Augusta, Kan. The improvement consists in connecting to the handle of a pump, by suitable devices, a rotating bucket wheel, placed under the delivery spout of the pump. The weight of the water in the buckets rotates the wheel, and helps to operate the pump handle and lessens the labor of working the same. The water falls from the buckets of the wheel into a trough, and is conducted by a spout to any desired point.

Mr. Albert J. Gary, of Denison, Ia., has patented devices for transmitting the rotary motion of wind wheels directly to the work, avoiding the crank motion commonly used. The shaft of the wind wheel is attached to a horizontal shaft which has bearings in the top of the wheel supporting, and revolves about an upright shaft to which it is connected by bevel gear wheels, to impart the rotary motion of the wind wheel to the shaft. This shaft gears in like manner to a horizontal shaft supported near the ground, from which the motion is transmitted by cone pulleys for any work desired.

An improved saw mill dog, by which logs are held more firmly on their carriages, has been patented by Mr. James B. Finch, of Bozeman, M. T. To the under side of an ordinary mill dog is hinged an auxiliary dog, the jaws of the two dogs projecting toward each other. To the upper side of the lower dog a curved toothed rack bar is attached, that passes through a slot in the forward part of the upper dog and has at its upper end a handle. On the upper side of the main dog in front of the rack bar is swiveled a toothed lever that engages with the curved rack, and when the lever is pressed down the dogs are forced into the log, and if raised the dogs are withdrawn from the log.

ELECTRICAL INVENTIONS.

An electric safety elevator has been patented by Messrs. Henry B. Sheridan, of Cleveland, O., and Hermann A. Gorn, of New York city. The well of the elevator has, in diagonally opposite corners, toothed racks, with which worms secured to the shafts at the corners of the cars engage. The worm shafts are operated by gears driven by an electric motor placed on the top of the car. By means of a sliding clutch operated by a handle in the car, the gears are adapted to run so as to move the car up or down as desired. The same inventor has patented an improved regulating mechanism for electric lamps. A pivoted lever, carrying an armature on each end, interposed between high resistance and low resistance magnets, is connected by bars provided with spring pawls to a toothed wheel on which are placed cone pulleys carrying the carbon supporting chains, whereby, when the electric current passes through the low resistance magnets, the carbons will be separated, and when it passes through the high resistance coils, the carbons will be moved toward each other. Suitable devices for regulating the action of the electric current are also provided. An improvement in electric lamps, by which the carbons are moved with great steadiness and regularity, has also been patented by Mr. Sheridan. It consists in providing the carbon holders with friction rollers that move upon the guides, causing them to move down and up so easily that they will be affected by the most delicate changes in the current. They move steadily, without any jar, maintaining a uniform light.

AGRICULTURAL INVENTIONS.

Mr. Charles W. Dutcher, of Milltown, New Brunswick, Can., has patented an improved potato digger, in which the potatoes and soil are raised by a scoop from the hills and carried by means of paddles, operated by a chain belt from the axle of the digger, over a slotted frame, back to a shaker frame, which is vibrated by means of a zigzag projection on the inside of the drive wheel of the digger, and the potatoes are separated from the soil.

Messrs. H. R. Burger and J. B. Simpson, of Fin Castle, Va., have patented improvements in square harrows, which consist in curved springs attached to the side bars of the harrow and crossing each other over center, where a seat is secured for the driver, and in the peculiar manner of attaching the ends of the side bars, so that the harrow adapts itself to any unevenness of the ground, and also in the means of securing the harrow teeth to the frame.

A novel device for carrying hay to be stacked to the top of a stack has been patented by Mr. Johan C. Testman, of Wisner, Neb. An inclined way up which the hay is to be carried to the top of the stack is supported on a frame. A rake is placed in the inclined way, and is drawn from the ground to the height of the stack by a rope running through a sheave at the top of the frame, and thence through guide pulleys to the horse that works the rake. The hay being gathered about the foot of the way, the rake is set into it, and the rope drawn to haul the hay up the inclined way and discharge it upon the stack, the operation being quickly and easily performed.

MISCELLANEOUS INVENTIONS.

Mr. Edinboro Cyrus, of Augusta, O., has patented improvements in millstone dress, intended for making middlings previous to regrinding. The dress of the bedstone has intermediate furrows between the quarter furrows, and near the center of the stone are transverse channels that connect all the furrows. The runner stone has intermediate furrows between the quarter furrows, and the lands of each of the quarter furrows are connected with each other. The furrows are made gradually more shallow towards the periphery of the stone. By this dress the grain is distributed evenly and uniformly, and a better quality and greater quantity of middlings are produced.

Mr. Robert McShane, of Brooklyn, N. Y., has recently patented a double stroke gong bell, that can be readily changed for right or left hand connections, as required for use. The supporting plate, gong, and hammer are of the usual construction. The trip is formed with three arms, one engaging with the operating lever, and the others with the hammer arm. The operating lever is pivoted to the supporting plate, and is provided with two lugs on one of its edges, one above and the other below the pivot. A spring connects from a stud placed opposite the pivot of the lever to one of the lugs. When a right hand connection is made the spring connects with the upper lug, and when a left hand connection the spring is placed on the lower lug.

Messrs. Lewis Coates and Joel T. Criswell, of Collamer, Pa., have patented an improved butter print or press by which butter is quickly and evenly formed into cakes of required weight without previous weighing. The press is a sliding box, in which the butter is placed, and pressed on a printing block, by a follower, moved by suitable levers. The follower is provided with an aperture, and as the compression chamber contains more butter than is required for the cake, the surplus butter is forced out through the aperture, and the finished cakes have exactly the same size and weight.

An automatic grain sampler, to be used in combination with a grain weighing and delivering apparatus, has been patented by Mr. Washington Hawes, of Port Richmond, N. Y. The receiving and weighing devices are of the usual construction. From one side of the receiving vessel a tube projects, that receives from the vessel and holds a given quantity of grain, forming a measuring sampler. At the inner and outer ends of the tube are valves that are operated by rods and eccentrics on the tube attached to the rock shaft, that opens and closes the delivery valve of the receiver. By this means each draught of grain is sampled.

Mr. William T. Abbott, of Fort Wayne, Ind., has patented a stock car in which cattle may be separated from each other by means of partitions hinged to a vertically adjustable frame that is raised and lowered from the top of the car by screws, and a space for the storage of food for the cattle is provided when the frame is let down. Feed troughs are also suspended by screws, to be let down for the use of the cattle. These parts may be all raised to the roof of the car, when cattle are not to be carried, when the car can be used for other freight if desired.

A device by which the bearings and wearing surface of watch movements may be easily supplied with small and suitable quantities of oil has been patented by Mr. William W. Martin, of Salem, Or. The oiler consists of a handle containing an oil reservoir, provided with an attached hollow needle point for depositing the oil. By simply touching the point of the tube to the surface to be oiled, the oil will be deposited from the tube in very small quantities, just sufficient for properly lubricating the bearings and wearing surfaces.

A lantern that can be easily attached to the collar of a lamp of ordinary construction has been patented by Mr. Charles F. Anderson, of Bay City, Mich. The body of the lantern is provided with a movable bisected bottom, and the ball of the lantern passes through the top of the frame at diagonally opposite corners and through braces at the bottom of the frame, and is secured to the outer angles of the bottom pieces. It is bent in such shape that when it is pressed down the bottom pieces are thrown apart, and when it is drawn up the pieces close together to grasp and hold the collar of the lamp.

A combined tape line and shears for measuring and cutting ribbons, etc., has been patented by Mr. John C. Kulman, of Marshall, Ill. A tube projects from the reel case of the tape line, through which the outer end of the line is passed, and to the end of the tube shears are secured. A loop is placed on the tube in which the middle finger of the hand is placed, and the shears are so constructed that the movable part of the shears are easily operated by the thumb of the hand. The tape line is drawn with the article to the proper distance, and a cut is made with the shears.

A device by which the tires of wheels may be tightened, when they have become loose, has been patented by Mr. Sylvanus B. Robison, of Valparaiso, Neb. An iron felly section, having a longitudinal slot, is secured to the tire and the wooden felly at one side of an opening in the tire. A slotted bar is attached to the tire on the opposite side of the opening, and works in the longitudinal slot of the felly section. A wedge or key driven between the ends of the two slots tightens the tire by drawing the opposite ends together.

Mr. James Iredale, of Toronto, Can., has patented improvements in oil stoves in which the oil receptacle is so constructed that the wick chambers are placed between central and side flues, the burners having double draught passages that insure more perfect combustion of the oil. On top of the jacket of the combustion chamber is placed an oven that is surrounded by a jacket, the products of combustion passing through the space between the two. Water heating and cooking utensils having hollow arms that project into the space between the bottom of the oven and the jacket are secured by hooks to the outer surface of the jacket. By these means the stove is adapted to do a large amount of work.

Some improvements in suspenders have been patented by Mr. Johann W. Höltring, of Barmen, Germany. They consist in uniting the rings to which the button hole straps are attached, by straps resting against the sides of the body, above the hips, whereby, when the suspender straps are attached to the rings, triple joints are formed, and the folding of the strap or under pressure on the body is avoided. The button-hole straps are attached to buttons placed at equal distances on the front and rear of the side seam of the pants.

A novel gag runner for check reins has been patented by Mr. William H. Chapman, of Middletown, Conn. The gag runner is made with a swinging loop that is swiveled on a bridge of a frame through which the check rein passes. The bridge has a spur projecting from its under side into an aperture in the check rein for holding the gag runner to the rein.

A device for supporting the body and wheels of a carriage for painting, and by which they may be adjusted in any desired position, has been patented by Mr. Eugene Cook, of Nashville, Mich. It consists of a hollow tube supported on a suitable base, and adapted to receive and engage with a screw threaded shaft, to the upper end of which is secured, by a double knuckle joint, a frame for supporting a carriage body, and devices for securing the body to the frame, whereby the body can be raised or lowered, or adjusted to any desired angle and clamped in that position.

An automatic device for feeding horses or other animals at fixed times has been patented by Mr. Eugene Wessells, of Peekskill, N. Y. The bottom of the hopper in which the feed is placed is a slide, and is pressed back against a spring, in which position it is held by one arm of a lever, the other arm of which rests against the flat handle of the winding key of the alarm of an alarm clock. When the alarm of the clock begins to operate the lever is released, and the spring throws the sliding bottom out of the hopper, allowing the feed to fall to the feed box.

A self-acting machine that applies a layer of jelly between two cakes, or a dressing of icing to the top of a single cake, has been patented by Mr. Daniel M. Holmes, of Cincinnati, O. By a peculiar construction and arrangement of devices, a row of cakes are fed on to a main belt, and carried under jelly boxes, where a definite quantity of paste is discharged and the supply is then positively shut off. As the cakes move along on the belt they pass under cake-holding tubes, from which cakes are carried by suitable devices and placed on the tops of the cakes that have passed under the jelly boxes.

Mr. Andrew T. Morrow, of Tonganoxie, Kan., has patented a light, cheap, and durable gate suitable for use with the barbed wire fence. The opening between the posts is closed by barbed wires secured at their stationary ends to rings on the post, and at their opposite or swinging ends are attached to a wooden bar having slits sawed in its top and bottom. Stay bolts are put through the slits near the inner ends that serve to keep the bars from splitting and as part of the fastening. On the side of the post next the bar are catch bars notched on their edges to receive the bolts of the bar. In closing the gate the lower end of the bar is placed on the lower catch, and the upper is drawn forward, stretching the wires, and is held to the upper catch by means of a weighted catch that is held closed.

Mr. Charles W. Allen, of Pine Ridge Agency, D. T., has patented improvements in billiard tables, consisting of the combination with the bed and frame of the table, of adjustable cleats to which the cloth is attached, and devices for operating the cleats, to stretch the cloth smooth and tight, and for removing it when desired. Also in combining with the bed and frame of the table, of arc shaped frames, and a spherical segment, and screw and nut, for placing and securely holding the table in a perfectly level position.

A crosscut sawing machine, having two saws, one of which is adjustable to cutting different lengths, has been patented by Mr. George A. Moffat, of Mineral Springs, Ark. The saws are both operated by one driving shaft, to which they are connected by rods and eccentrics. One of the eccentrics is adapted to be readily shifted on the shaft for the different lengths to be cut. The saws are so pivoted to the connecting rods that they may be turned upright, and also to prevent them from falling below the line of the connecting rods.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

To Inventors.—Wanted, the most simple and inexpensive process by which coffee can be roasted in lots of 20 to 25 pounds. Heat to be cheaper than that of coal. Address "Opportunity," Box No. 77, Brooklyn, E. D., N. Y.

To learn Inventing, Designing, and Construction of Machinery at school, address Prof. S. W. Robinson, Ohio State University, Columbus, O.

The Obelisk in the Central Park, New York, weighs two hundred tons, or is equivalent to the weight of about eight hundred and twenty millions of Esterbrook's Ladies' Pens.

SOUTHAMPTON, L. I., Aug. 13, 1882.
H. W. Johns M'f'g Co., 87 Maiden Lane, New York:
DEAR SIRS: Your colors received all right, and are magnificent; never saw anything go on so easily and cover so well. The tints are just O. K., and very delicate. Sincerely yours, A. T. BRICHER.

The American Machine Co., N. E. cor. Lehigh Ave. and American St., Philadelphia, Pa., is prepared to execute contracts for the manufacture of light machinery.

Wanted.—To know Drop Forgings Manufacturers. G. G. Buckland, Tulare, Cal.

See Bentel, Margedant & Co.'s adv., page 157.

Cope & Maxwell M'f'g Co.'s Pump adv., page 157.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Machine Diamonds, J. Dickinson, 64 Nassau St., N.Y.

The Berryman Feed Water Heater and Purifier and Feed Pump. I. B. Davis' Patent. See illus. adv., p. 157.

50,000 Sawyers wanted. Your full address for Emerson's Hand Book of Saws (free). Over 100 illustrations and pages of valuable information. How to straighten saws, etc. Emerson, Smith & Co., Beaver Falls, Pa.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad., p. 157.

Gould & Eberhardt's Machinists' Tools. See adv., p. 158.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 157.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 157.

Red Jacket Adjustable Force Pump. See adv., p. 158.

Vertical Engines, varied capacity. See adv., p. 156.

Fine Taps and Dies in Cases for Jewelers, Dentists, Amateurs. The Pratt & Whitney Co., Hartford, Conn.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 158.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

4 to 40 H. P. Steam Engines. See adv. p. 94.

Drop Forgings. Billings & Spencer Co. See adv., p. 141.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 143.

Knives for Woodworking Machinery, Bookbinders, and Paper Mills. Taylor, Stiles & Co., Riegelsville, N. J.

The Sweetland Chuck. See illus. adv., p. 126.

Lightning Screw Plates, Labor-saving Tools. p. 126.

Engines, 10 to 50 horse power, complete, with governor, $350 to $550. Satisfaction guaranteed. Six hundred in use. For circular address Heald & Morris (Drawer 127), Baldwinsville, N. Y.

Mr. T. D. Lockling, care U. S. Consul, Panama, U. S. Colombia, will sell the whole or a portion of his patent for umbrellas, illustrated on p. 82, this volume.

Air Pumps for High Pressure, Hand, or Steam Power, at low prices. C. Beseler, 218 Center Street, New York.

See New American File Co.'s Advertisement, p. 110.

Steam Pumps. See adv. Smith, Valle & Co., p. 109.

Small articles in sheet or cast brass made on contract. Send models for estimates to H. C. Goodrich, 66 to 72 Ogden Place, Chicago, Ill.

Improved Skinner Portable Engines. Erie, Pa.

Combination Roll and Rubber Co., 68 Warren street, N. Y. Wringer Rolls and Moulded Goods Specialties.

Pure Water furnished Cities, Paper Mills, Laundries, Steam Boilers, etc., by the Multifold System of the Newark Filtering Co., 177 Commerce St., Newark, N. J.

"Abbe" Bolt Forging Machines and "Palmer" Power Hammers a specialty. Forsaith & Co., Manchester, N.H.

List 28, describing 3,000 new and second-hand Machines, now ready for distribution. Send stamp for same. S.C. Forsaith & Co., Manchester, N.H., and N.Y. city.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, polishing compositions, etc. Complete outfit for plating, etc. Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

Latest Improved Diamond Drills. Send for circular to M. C. Bullock Mfg. Co., 89 to 93 Market St., Chicago, Ill.

First Class Engine Lathes, 20 inch swing, 8 foot bed, now ready. F. C. & A. E. Rowland, New Haven, Conn.

Ice Making Machines and Machines for Cooling Breweries, etc. Pictet Artificial Ice Co. (Limited), 142 Greenwich Street. P. O. Box 3083, New York city.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users & engineers. (Forward above by postal or letter; mention this paper.)

Steel Stamps and Pattern Letters. The best made. J. F. W. Dorman, 21 German St., Baltimore. Catalogue free.

Machinery for Light Manufacturing, on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

For Power & Economy, Alcott's Turbine, Mt. Holly, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Supplement Catalogue.—Persons in pursuit of information on any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Presses & Dies (fruit cans) Ayar Mach. Wks., Salem, N.J.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) R. M. L. writes: 1. In the SUPPLEMENT, No. 162, there is described a small steam boiler constructed of mercury flasks. Now, I want to know what mercury flasks are, what are their size, are they all the same size, where can I obtain them, and about what are they worth? A. Mercury flasks are of wrought iron, welded up. You can see them at any extensive drug store. They are all very nearly the same size, about 5x10. They can be purchased from druggists, and worth about $1.50 each. 2. I am an engineer, and have charge of a high pressure cut-off engine (30 horse power), supplied with steam by a 2½ inch steam pipe 200 feet long from boilers to engine; it runs under the floor a distance of 96 feet (horizontal), and connects to steam chest by a perpendicular pipe about 5 feet high. Now, what I want to ask is, how to drain the condensed water from this horizontal 96 foot section effectually, as it is very annoying, troublesome, and dangerous. A. You can have a blow valve or cock connected to the lowest part of the pipe, and blow out the water from time to time as necessary; or you can set a receiver for the condensed water below the lowest part of the pipe and pump, or blow the water from the receiver.

(2) G. H. M. writes: 1. I am about to build a light draught steamboat, 60 feet long and 18 feet beam, width of submerged section about 10 feet. Will a 16-horse power engine and a four-foot propeller, with six feet pitch, drive her fourteen miles per hour? A. No, probably not more than ten or twelve miles, and then it must be a good model. 2. What should be the width between the saddle and stern post to leave sufficient space for the propeller? A. Sixteen inches at least—more would be better.

(3) E. W. asks: 1. If a boat that runs ten miles an hour in still water be placed in a five-mile current, will its speed in that current be fifteen miles an hour, or less? A. More. 2. Will it take a boat a shorter time to turn around (either half-way or completely), going against a current, than it will going with it, or will the time be the same in both cases? I maintain that the current would have no effect whatever either to retard or accelerate the boat's turning, but that the time in both cases would be the same as in still water. These questions leave out of consideration the resistance of the air. A. If the boat was exposed to an equal current there should be no difference. 3. If two bullets be fired from the same point in a direction parallel to the earth's surface, one with two or three times the velocity of the other, will they fall to the ground in the same time, or will the one with the less velocity reach the ground first? A. Leaving out of the question the atmospheric resistance, they should fall in the same time.

(4) J. F. B. writes: I have made a coil boiler for a steam launch in the manner described below. I have three coils arranged concentrically. The outside is of 1¼ pipe, 20 inches diameter, 5 turns; the next is of 1¼ pipe, 14 inches diameter, 5 turns; the next is of 1 inch pipe, 9 inches diameter, 6 turns. The bottom ends of coils are connected to a piece of 1¼ pipe, the top of coils to a piece of 1 inch. I shall connect to a piece of 5 inch pipe, 18 inches long, but first I want to know where you would advise pumping, in top or bottom of coils; and shall I connect the 5 inch pipe at top and bottom? Will this furnish steam enough to run a 3x4 engine 250 turns per minute? I will heat water at about 150 degrees before entering boiler. Would it be beneficial or detrimental to feed air in with water? A. For your coil boiler we advise pumping the water in at the bottom turn of the coils. Use the 5 inch pipe for a steam chamber or separator, as coil boilers sometimes throw water over. Place the chamber or separator a little above the coil. Let the steam enter at one end or on top, also connect the lowest part directly with the bottom of the coil, then you will have tolerably dry steam. Take the engine pipe from the highest point and as far away from the inlet from coil as possible. Your boiler has surface enough for 1½ horse power. Your engine, working at 80 pounds pressure, is about 1 horse power. With this form of boiler, on so small a scale, we doubt of your getting so high a result. One half the above figure might be obtained. Air has been fed or injected for a combined steam and air engine and a saving has been claimed; but it is possible that the cost of condensing air was not considered.

(5) W. J. B. asks: How many pounds of steam will I have to carry to have superheated steam 500° Fah.? A. You will not have superheated steam by simply increasing the pressure. Pressure due to 500° is about 700 lb. You must superheat by passing the steam through or over hot metal or other hot surface.

(6) F. C. E. asks: 1. In a bichromate cell, how far apart should the two 6x8x¼ plates be? A. One-fourth or three-eighths inch.

(7) J. A. I. writes: I am firing a return flue boiler, and the flues are said to be heavily coated with scale, and the water keeps very clear. Will black oil remove or dissolve the scale, and what effect does it have upon the boiler, if any? I have heard it would clean off the scale. A. We think the oil will remove the scale, but the boilers will probably foam badly during its use. Two or three blocks of oak timber put in the boiler will also effect the result. In either case it depends upon the character of the scale. Use the oil cautiously—small quantity at first.

(8) E. O. asks how to prepare a cement for filling faults in castings. A. Iron filings, free from rust, 10 parts; sulphur, 0·5; sal ammoniac, 0·8. These are mixed with water to a thick paste, which is rammed into the "faults." This becomes strong when the iron filings are rusted. The parts which have to be cemented are treated before the operation with liquid ammonia, so as to be perfectly free from grease.

(9) A. M. asks how to make soft peppermint drops. A. The following, which we take from the *Confectioner and Baker*, will give the information you desire: Take a convenient quantity of dry granulated sugar; place it in a pan having a lip from which the contents may be poured or dropped; add a very little water, just enough to make the sugar a stiff paste, two ounces of water to a pound of sugar being about the right proportion; set it over the fire and allow it to nearly boil, keeping it continually stirred; it must not actually come to a full boil, but must be removed from the fire just as the bubbles denoting the boiling point is reached begin to rise. Allow the sirup to cool a little, stirring all the time; add strong essence of peppermint to suit the taste, and drop on tins, or sheets of smooth white paper. The dropping is performed by tilting the vessel slightly, so that the contents will slowly run out, and with a small piece of stiff wire the drops may be stroked off on to the tins or paper. They should then be kept in a warm place for a few hours to dry. If desired, a little red coloring may be added just previous to dropping, or a portion may be dropped in a plain white form, and the remainder colored. There is no reason why peppermint should alone be used with this form of candy, but confectioners usually confine themselves to this flavor. Any flavor may be added, and a great variety of palatable sweets made in the same manner. If desired, these drops may be acidulated by the use of a little tartaric acid and flavored with lemon, pineapple, or banana. In the season of fruits, delicious drops may be made by substituting the juice of fresh fruits, as strawberry, raspberry, etc., for the water, and otherwise proceeding as directed.

(10) H. J. C. writes: I have made a machine after the drawings in SUPPLEMENT, No. 161, and it works; but not as well as I think it should. Running at 1,500 revolutions per minute: 1. How many incandescent lamps, Edison style, will machine referred to run, and what size of wire should machine be wound with for that purpose? A. It will run two Edison three candle power lamps. Magnet should be wound with No. 16 wire, and the armature with No. 18. 2. What size of wire should machine have for one lamp? A. The same size will do. 3. How many incandescent lamps can be run by one horse power? A. Mr. Edison runs 10. 4. Will an alternating current injure an incandescent lamp? A. We believe the lamps are sooner destroyed by an alternating current than by a continuous direct current. 5. How many hours will an Edison incandescent lamp last when run by an alternating current? A. We know of no experiments in this direction. 6. Is there any gain by winding one half of armature with one size of wire for charging its electromagnets, and the other half for outside use? A. Yes; if you make your armature double, *i. e.*, of two armatures, placed end to end, and increase the width of the field magnet.

(11) J. M. P. says: In reading the SCIENTIFIC AMERICAN of December 1, 1877, an account of the Pictet ice machine, you mention an article called anhydrous sulphurous oxide. Would be pleased if you would inform me where I can obtain it. I have tried a great many drug stores of this city, but so far could not obtain it. A. We are informed that the Pictet Artificial Ice Company of this city are the only importers of anhydrous sulphurous oxide; sold by them as the refrigerating agent in their ice making machines. It is manufactured in Paris; furnished in carboys holding about 200 pounds each, and imported to order. Can be procured only from the Pictet Artificial Ice Company, who will not sell less than one carboy, value $205.

(12) J. R. writes: We are using two cylinder boilers at a steam saw mill. My sons and myself differ in opinion in regard to feeding the same with water, the head and force of water being nearly or quite sufficient to feed boilers without using inspirator. My sons contend for the use of steam to heat and feed by use of inspirator. I contend that it would save steam by letting the cold water flow directly into boilers. A. It will be better for your boilers to feed with the inspirator if you cannot otherwise heat the feed water. There will be no loss.

(13) J. B. F. asks to how make a solution to temper marble tools that they will stand to cut Italian marble. A. The ordinary solution for hardening stone-cutting tools is salt and water, about one quart of salt to a pail of water. Harden at as low a heat as possible. Make your tools of what is called "chisel steel." It is a lower and tougher grade than the fine grained "tool steel." Acids, mercury, ice, or any fluids that have density, or coldness, have been used and recommended for hardening various kinds of steel, and for various purposes. If your steel is drawn at its proper heat, and also hardened at its lowest possible hardening heat in salt water, and the temper drawn as little as possible, and if it does not fly or chip, you will have the best chisel that can be made for any kind of work. The great fault of blacksmiths is, that they first burn the steel, then harden at too high a heat, and spoil the tool by over-tempering.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

T. S. M.—The green soapstone-like stone is marmolite, of little or no value unless obtainable in large clear bowlders. It can then sometimes be worked to advantage for sundry ornamental purposes. The other sample is imperfectly crystallized pectolite. It is of little use or interest except to mineralogists.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

August 15, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1865, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 361 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1865; but at increased cost, as the specifications not being printed, must be copied by hand.

Air compressor, J. B. Waring 262,841
Amalgamating apparatus, J. L. Stewart 262,826
Amalgamator, J. G. Arrington 262,834
Axle, vehicle, E. Brulé 262,713
Bale ties, machine for finishing the blanks of wire, E. S. Lenox 262,797
Bale ties, machine for forming blank hooks for wire, E. S. Lenox 262,796
Banjo, B. Bradbury 262,844
Basket stave jointer, W. E. Hinchey 262,770
Bathers, safety apparatus for sea, L. D. & J. B. Smith 262,849
Bed, sofa, A. Kulich 262,901
Bed, spring, E. P. Fowler 262,836
Bedstead, cabinet folding, W. A. Morrison 262,817
Bedstead, folding, Adgate & Hickman 262,892
Belt fastener, A. Dihn 262,876
Belt tightening machine, F. N. Gardner 262,780
Bier, G. W. Moorman 262,815
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Boot or shoe, S. K. Hindley 262,892
Boot strap fastener, W. Smith 262,696
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Bottle stopper, D. S. Cooke 262,574
Bottle stopper, A. E. Rich 262,904
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Brewing malt liquors, J. F. Gent 262,761
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Brick kiln, S. J. Plant 262,614
Brick machine, E. Fales 262,563
Buckle, suspender, C. L. Hosford 262,573
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Bush and bung for barrels and kegs, A. Kirchner 262,909
Button, cuff, J. W. Miller 262,606
Cable way grip apparatus, H. Casebolt 262,640
Candles, apparatus for manufacturing, A. Hengert 262,881
Cans with meat, fish, etc., maching for filling, A. Crosby 262,913
Car brake, P. Lord 262,809
Car brake, H. F. Nothohm 262,690
Car brake, automatic, A. J. Berg 262,636
Car coupling, E. E. Frantz 262,659
Car coupling, C. Hendricks 262,664
Car coupling, T. F. McNair 262,805
Car coupling, N. Mereness 262,809
Car coupling, F. Sweetland 262,894
Car coupling, D. W. Woods 262,899
Car door lock, J. H. Fisher 262,585
Car heater, J. M. Thayer 262,834
Car starter, T. Owens 262,823
Car stock, S. P. Tallman 262,727
Car, tamping, W. E. Davies 262,746
Car ventilator, H. A. Gouge 262,646
Car wheel, G. W. Miltimore 262,909
Car wheels, making, G. W. Miltimore 262,910
Carburetor, H. C. De Witt 262,651
Carpet stretcher, G. W. Barton 262,560
Carriage spring, C. M. Brown 262,567
Carriage top, E. Myrick 262,609
Cart, road, J. B. Callan 262,738
Cart, road, W. Chegwin 34,570
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Chain swivels, making, J. E. Walcott 262,681
Channels, apparatus for deepening, G. Peterson 262,824
Check holder and check for baggage, C. S. Russell 262,606
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Chuck, drill, J. H. Hoague 262,771
Chuck, lathe, C. Parham 262,613
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Churn, B. S. Miles 262,810
Cigar perforator and cutter, combined, F. Jacob 262,675
Clock movement, H. Camp 262,730

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Clother drier, G. W. Hutchins 262,779
Clothes pounder, J. P. B. Berry 262,830
Clutch, H. R. Allen 262,553
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Cuff and dress supporter, T. R. Boone 262,563
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Cut-off valve, M. N. Cummiskey 262,849
Cutter. See Bolt cutter. Label machine cutter.
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Door check, R. H. Barnard 262,557
Door hanger, W. H. Wilder 262,714
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Felly, vehicle wheel, E. Danford 262,650
Fence, E. Meyer 262,695
Fence, iron picket, J. Woodhill 262,879
Fence wire reeling machine, A. M. Munson 262,696
Fifth wheel, vehicle, A. E. Hermann 262,660
File holder, paper, W. D. Doremus 262,900
File, metallic bill, J. C. Lang 262,705
Filter, Sears & Burnham 262,702
Fire alarm and fire extinguisher, combined, C. E. Buell 262,897
Firearm, magazine, Malkoff & Paskin 262,806
Fire escape, P. S. Scovel 262,877
Fire escape, W. H. Souther 262,627
Fire extinguisher, E. Briggs 262,730
Fire extinguisher, automatic, C. L. Horsch 262,776, 262,777
Fire extinguishers, spray nozzle for, L. C. Desloovere 262,578
Flying machine, C. F. Myers 262,687
Force feed lubricator, R. G. McAuley 262,692
Forks, machine for making pitch, P. E. Bird 262,562
Furnace door, A. Howatson 262,665
Furnace grate, W. E. Hartun 262,949
Gas generating machine, M. R. Spelman 262,704
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Glove or boot fastening, H. W. Ducker 262,653
Grain and seed sampler, S. H. Stevens 262,847
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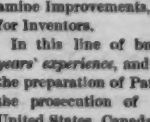
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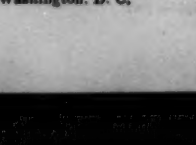
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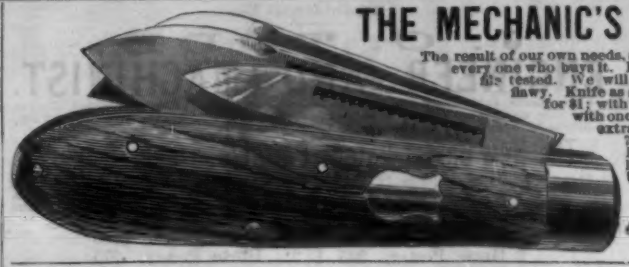

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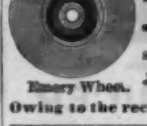

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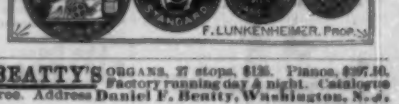

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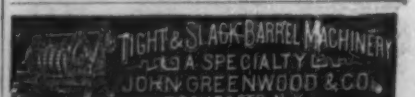

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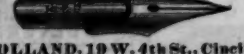

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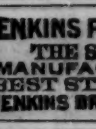

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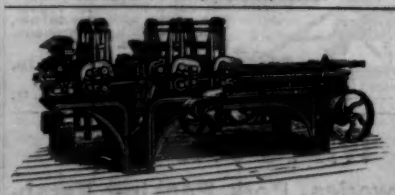

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